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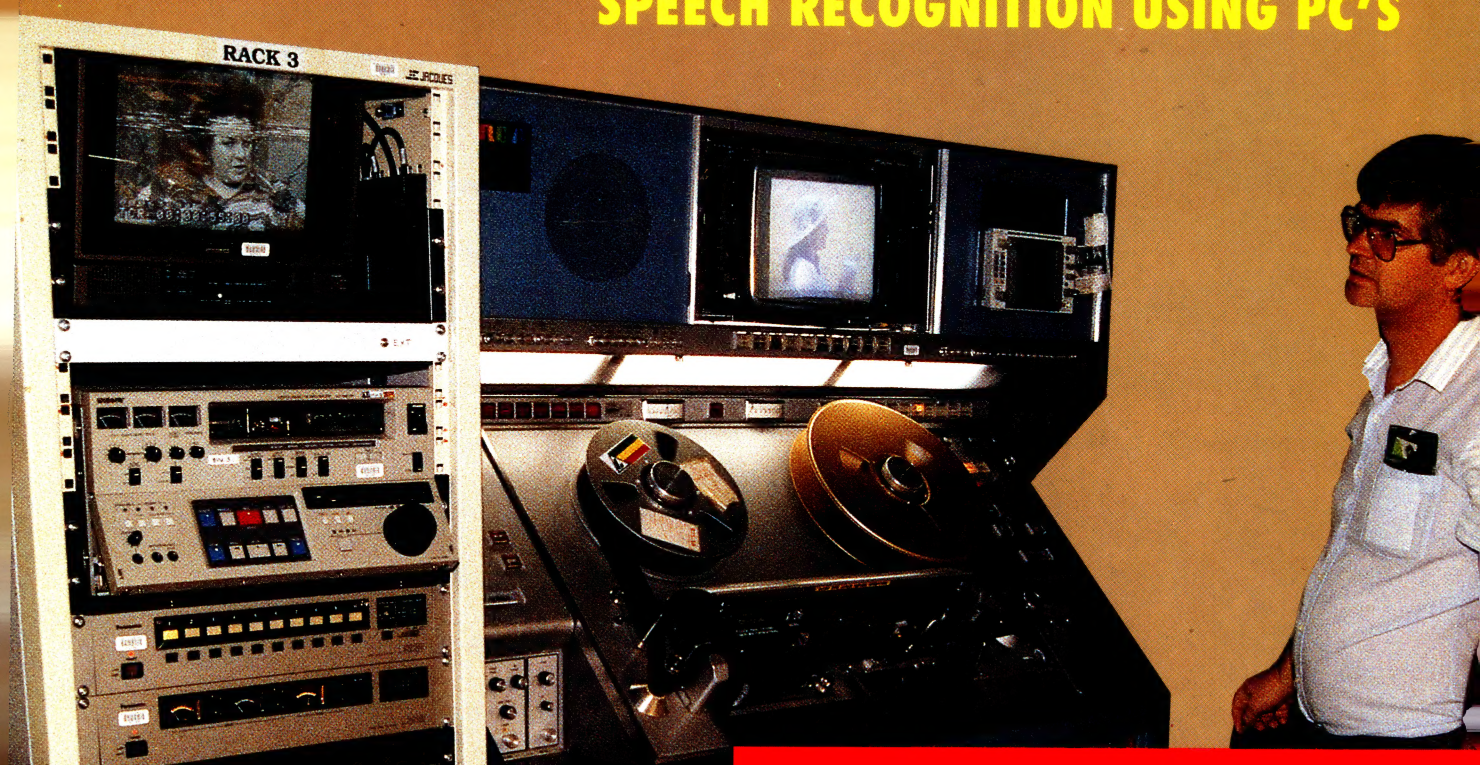

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Volume 56, No.4
April 1994

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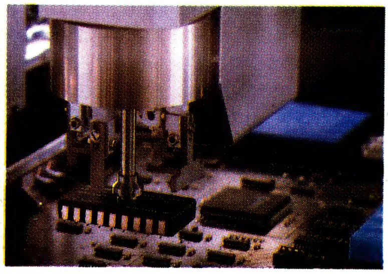
Clearer pics from the HST

Shortly before this issue had to go to the printer, a package arrived from NASA with samples of the images being produced by the refurbished Hubble Space Telescope. They're much clearer — see page 107.

DC/DC converter chips...



Ericsson Components has released a series of DC/DC converters in dual-inline packages, with power levels up to 7W. Both through-hole and SMD versions are available. (See Components Feature, page 120.)

On the cover

Australia's National Film and Sound Archive in Canberra is now officially 10 years old, and EA's Editor Jim Rowe was invited down to look at what has been achieved to date. It's very impressive, as he explains in the story starting on page 26. (Pictures by Arthur Mostead, courtesy NFSA..)

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LETTERS TO THE EDITOR

Early radio

Your article about 2FC and 2BL in the January issue brought back memories of the early thirties when we lived just South of Mr Egmont; in those days we had one national station in each of the main cities, plus a few privately operated smaller stations. At that time the Australian stations used to be heard at quite good strength in the late afternoon and early evening and we often listened to the children's session from 2GB with Uncle George and Bimbo, on the frequency of 950Kc/s if my memory serves me correctly. 2UE was also heard regularly at good strength and in those days the American KFI used to be heard frequently on 650Kc/s, and on shortwave VK2ME and VK3ME came in well and I sighted their QSL cards amongst my memorabilia recently.

Those were the days of the British broadcasts from Daventry and KDKA from USA. There was another American station from Bond Brook that used to come in well, but I cannot bring its call to mind; maybe it was something like W3XL, but it doesn't look right. Perhaps one of your readers can correct me. Those were the fun days of radio; there was magic in hearing a station that you hadn't heard before that is absent nowadays. Anything you want to hear is buried under a mass of tinpot stations, QRM and QRN etc, and we are stuck with our locals.

I have been reading your mag since it was Radio & Hobbies and enjoy Serviceman (I was one myself for 50 years) and Moffat is writing good stuff too. I remember when you first joined the staff! Hope you've got many good years left.

R.T. Salter, ZL1ATO,
Russell, New Zealand.

Monitor jitter

I would like to respond to your correspondent Mark Clemow, whose letter was published in the December 1993 issue. I have had a very similar experience with my PC, and the problem has only just been solved.

When I first installed the computer three months ago, the screen display suffered from a horizontal jitter which varied in intensity from mild in the daytime to severe at night. The extent of the jitter changed in sudden jumps, apparently as electrical appliances were being turned off and on.

I suspected electromagnetic interferenc at 50Hz, but had trouble locating th source. To cut a long story short, it wa eventually traced to a strong current flowing into the house through the water pipe which runs across the ceiling space abov the room where the computer is, and vi the earth bonding connection to the mai neutral, and thence back to the local supply transformer.

The source of the stray current was faulty main neutral connection to som nearby houses — nothing at all to do wit the electrical installation in my ow house! Neutral current from the othe houses, not being able to return to th transformer by the normal path, was flowing via the MEN connections to earth finding the path of least resistance throug our good neutral and earth connections.

Thus we ended up with a strong stra current, varying from four to 12 amps i the day time when we were testing, an who knows how much at night. As yo know, normal electrical installations pu active and return conductors clos together so that their magnetic fields cancel. But our unbalanced stray current wa producing a strong magnetic fiel wherever it went, hence causing the computer screen jitter. Now that repairs hav been made, the problem is fixed.

So my suggestion to Mr Clemow is t have his local supply authority check ou the neutral connections to his neightbours houses. It is very likely that one or more o them has an open-circuit fault, and he i receiving their return current through hi own MEN connection.

Kevin May, VK5IV,
Kangaroo Ground, Vic.

Component stocks

I have been concerned with the sever lack of service offered by electronic shops in Melbourne for a while now, but trip into town yesterday moves me to express these feelings. I went specifically t get a few extra components for a project am working on, as well as a transforme for an amplifier I had lying around.

I went into one shop and browse around, finally ending up in front of a she of transformers. I look around and coul not see the one I needed, so I asked th nearest shop assistant. I told him what sought, and his expression showed he ha no idea what a 28-0-28 volt transformer was. When I said it was for an ETI 480 amplifier — surely the one kit everyone has heard of — he reacted as if I was from outer space.

"Do you want to hook it up to something?" he asked me. I should have said no, I was in the market for an expensive paperweight, but I restrained myself. Moments later his superior explained that no, they didn't have one. "Do you have any out the back?" I asked in desperation. No they didn't, but would next week. I gave up and found the transformer in another shop.

This is, of course, only one example of my experiences with bad service in electronics shops. I fear I will never find a decent component supplier in Melbourne; maybe the current ones could lift their game.

John Ford,
Kew, Vic.

'Timeframe?'

Would you please join my crusade to stamp out the buzzword 'Timeframe' from the English language and particularly from *Electronics Australia*.

A 'frame' has both length and breadth whereas 'time' has only length. You can have a 'timespan' or 'a length of time' but you cannot have a 'timeframe'.

I have noticed a tendency for this word to creep in for some time and from several of your contributors, but the most recent example was by the esteemed Neville Williams in his fine 'When I Think Back' column of January, where he said in the first paragraph, 'Over much the same timeframe, telephones have evolved...' I'm sure he meant, 'Over much the same period of time'.

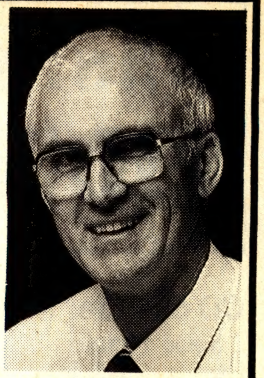
I suppose we must accept 'AC current' for alternating current' and 'different to' instead of 'different from', but 'timeframe' hits at the very heart of what *Electronics Australia* is all about, which is clear and logical thinking.

C.G. Singleton,
Lower Hutt, New Zealand.

Comment: I take your point, Mr Singleton. But surely the use of one word doesn't 'strike at the very heart' of what the magazine is all about? The English language is a living and dynamic entity, after all; words gradually evolve new meanings, in response to the needs of the users of the language. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Next step in the digital video revolution?

You may recall that in the September 1993 issue, I discussed here the significance of Mini Disc (MD) and Digital Compact Cassette (DCC), as the first domestic applications of *compressed* digital audio recording. Perhaps rashly, I suggested that these new formats represented the start of an exciting new era in audio recording — even though their public acceptance has been slowed down, and could even founder, for other reasons.

Nothing that's happened since then has changed the validity of this evaluation, as far as I'm aware. In fact I think it's time to stick my neck out again, this time with regard to the *video* side of the digital compression revolution.

There have been many rumblings of big developments in this area too, as well as papers in the learned journals and updates on the deliberations of MPEG — the international Motion Picture Experts Group — in formulating standards for digital video encoding. But it really wasn't until a couple of weeks ago, when I saw a demonstration of UK firm Nimbus Technology and Engineering's Video CD technology, that the full impact of these developments sank in.

What we saw, at that demo, was very respectable video and stereo audio coming from a standard 120mm compact disc, playing on an unmodified standard (although late model) audio CD player. The digital output stream from the player was then passing through a Nimbus decoder box, whose video and audio outputs were used to drive standard video monitors and audio amps.

Although the material we saw may well have been judiciously chosen to avoid obvious coding artefacts, most people who saw the demo were agreed that the subjective quality of both video and audio was quite impressive. The video seemed to be close to that from standard VHS videotapes, while the audio was close to that from a standard CD. Yet both were coming from a 120mm CD, recorded only a few days earlier in Sydney and playing at the standard speed. And using this currently available technology a single disc can play for up to 79 minutes.

What this really drove home is that the same rapidly-evolving techniques of digital data compression, which have made possible audio developments such as MD and DCC, are now close to achieving even more exciting breakthroughs in the field of video recording.

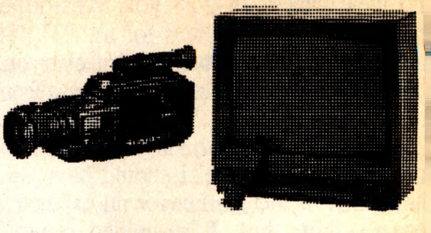
Think about it: right now, 79 minutes of domestic-quality MPEG-1 video and stereo audio can be recorded on a 120mm CD, at a data rate of only about 175 kilobytes or 1.4 megabits per second — less than *one-hundredth* the rate which was assumed necessary for video alone, as recently as 10 years ago. And firms like Nimbus are already achieving encouraging results with techniques to both double the playing time *and* boost the recorded image quality...

The compression technology probably still needs some further improvement, because ideally it should deliver full laserdisc-quality video from a CD. And there are of course techno-political, economic and consumer response factors, likely to slow down these developments before they reach the market. Nevertheless, it's now absolutely clear that digital compression technology is going to have a major role in the future of domestic video.

It's even possible that we may be buying and hiring movies on video CD's, within the next two or three years.

Jim Rowe

What's New in VIDEO and AUDIO



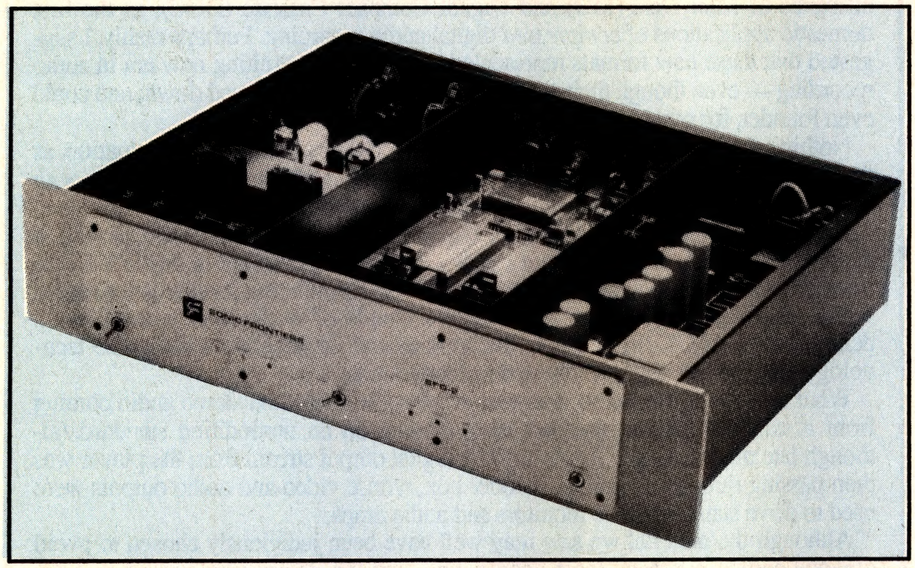
CD decoder for audiophiles

Sonic Frontiers of Oakville, Ontario, Canada, which is known for its range of tube pre-and power amplifiers, has made its debit into the DAC market with the introduction of the SFD-2 Digital Processor. Used in conjunction with a quality transport system, the SFD-2 is claimed to bring CD reproduction to a level of musical attainment previously unheard.

The SFD-2 is designed as a state of the art D to A converter. Features include 'true balanced topology' from the front end right through to the balanced outputs. Similarly, the most advanced chips currently available have been specifically chosen for their outstanc ing sonic qualities. These are combine with the use of tubes in the analo buffer stages and the very best han selected components.

Multi-bit conversion has bee employed rather than the current single bit designs, as Sonic Frontier contend th this technology provides 'ultimate musicality. At the heart of the SFD-2 ar dual Ultra Analogue DAC20400A 20-bi DACs, and separate dual DAC's are usec in each channel. The digital interfac receiver is also an Ultra-Analogu Device (AES20) which is purported t have the lowest jitter in the industry (les than 40ps). The digital filter is an eigh times oversampling NPC SM5803 AP as used in many top line competitiv brands such as the Mark Levinson 3 D/A processor.

The analog output stage is built aroun two specially selected low noise Sovte 6922 (E88CC) twin triodes supported b other quality parts including MIT multi caps, Vishay, Caddock and Holco (0.1% resistors, ceramic silver tube sockets 2.4mm (3.5oz) copper traces and AGS



Restyled mini stereo systems from Kenwood

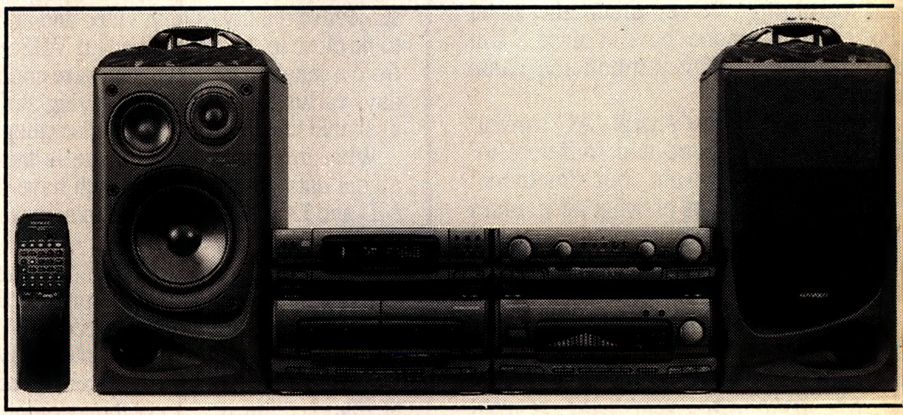
Kenwood has recently announced new additions to its UD series of mini stereo systems. The new line-up comprises the UD0951M, the UD-751M and the UD-551M. The UD-351M and UD301 were launched in mid 1993.

The new minis incorporate many features normally found in 'flagship' component designs, including Dolby Pro-Logic (UD-951M), DSP presence modes (UD-951M and UD-751M) and Kenwood's newest technology, 'Environmental Sound Enhancement'. This is designed to enhance musical enjoyment by allowing the user to play music from two sources simultaneously. Kenwood provide a free sound enhancement disc for this purpose (UD-951M and UD751-M). The UD-951M and UD-751M offer Kenwood's omni-directional speakers, which are effectively two completely separate speaker systems in each speaker enclosure. When used with Kenwood's four channel Digital Front Surround and DSP modes, two of the four channels carry the music and the other two deliver the ambience sounds.

Kenwood's active Natural Bass (NB) circuitry is also included in each model. The NB feature continually 'checks' the music content and provides the correct amount of bass to match. The NB feature is claimed to prevent the booming bass often found in competitive designs.

All models incorporate a quartz synthesised AM/FM stereo tuner, seven-band graphic equaliser/spectrum analyser, 6+1 magazine CD player, double auto reverse cassette deck with Dolby B and C, and magnetically shielded speakers.

The UD-951M is priced at $3259, the UD-751M at $2559 and the UD-551M a $2099. All models are covered by a three year warranty (12 months on CD lase pick-up) and are available from all Kenwood dealers. For information of you nearest Kenwood dealer, please call (02 746 1888.



A/V surround amp from Onkyo

The new Onkyo A-SV610PRO A/V Integrated Surround Amplifier is claimed to represent a breakthrough in affordable audio excellence, delivering professional A/V Surround Sound facilities at a down-to-earth price.

The A-SA610PRO delivers the brawn to make home theatre come alive, with 125 watts RMS per channel (eight ohms) in stereo mode, and 70 watts RMS to the front left, centre and right channels and 20 watts RMS to each of the rear channels in surround mode. And, in place of inexpensive hybrid IC amplifiers found in less quality units, each of the five channels in the A-SV610PRO is powered by completely discrete amplifier blocks, with individual components (no ICs) to produce dynamic, transparently clear sound from any source.

The unit is equipped with Dolby Pro Logic Surround Sound to faithfully recreate the dynamic realism of a movie theatre. The adaptive matrix circuitry steers the dominant sound to its proper channel while dampring the other channels, resulting in channel separation up to 25dB greater than ordinary systems.

Onkyo's Multiple Room Remote system is also incorporated into the A-SV610PRO to provide independent sound for a second room without the expense of a second system. By simply adding the optional HR-10W sensor and a second pair of loudspeakers, the A-SV610PRO efficiently drives two sound zones with full remote control from either room. The system can optionally control non-Onkyo TVs, VCRs or Laserdisc players.

The Onkyo A-SV610PRO measures 455 x 170 x 388mm, weighs 13.5kg, and is finished in black brushed aluminium. The recommended retail price is $1799.

silver hook-up wire. The SFD-2 Digital Processor has an RRP of $10,995 and is covered by a five year parts and labour warranty, (tubes 12 months). For further information contact Kedcorp on (02) 708 4388.

High resolution slimline 68cm CTV

Panasonic Australia has released a newly developed 'super slim' colour television known internationally as 'GAOO' (Japanese for 'King of Pictures', pronounced GAH-OH).

'GAOO' is produced in large screen 68cm and 78cm models and is characterised by its slim profile. The cabinet of the 68cm version is a mere 45cm deep, which is made possible by its use of a picture tube with a wide deflection angle of 112°. The 68cm model is being produced in Australia, at Penrith on the outskirts of Sydney.

'GAOO' uses an advanced electron gun developed for high definition television in Japan. It has an 'Auto Picture Equaliser' for optimum picture reproduction and a 'Super Flat Black Screen'. Sound quality is enhanced by the 'Auto Sound Equaliser' for bass and treble settings matched to the audio and the 'Hexacone Dome Sound System' reduces distortion by up to 90%.

Important technical advances include a new Large Overlapping Field lens electron gun, which Panasonic originally developed for use in high definition televisions. The 'Auto Picture Equaliser' consists of a CFU (colour feature unit) circuit and a multi AI (artificial intelligence) control unit. CFU automatically compensates for variations in the hue of flesh tones between different channels and video sources. It boosts the brightness of skin tones, eliminating problems of murkiness or shadows. The CFU's colour detail enhancer helps the TV reproduce precisely defined colours with extremely fine detail, while colour noise reduction reduces streaking noise. The Multi AI circuitry continuously monitors the video signal to always assure realistic images with plenty of depth.

Shielded speaker from Celestion

The new Celestion Shield range of magnetically shielded loudspeakers is designed to protect televisions, video monitors and video recorders from the adverse effects of stray magnetic fields. The Shield range is intended for home theatre installations and features among its five models a dedicated centre channel loudspeaker. A powered sub woofer is scheduled for release later this year. All the loudspeakers are fully magnetically shielded to prevent image distortion and stray magnetic fields. All four models share Celestion's titanium dome tweeter and display a visually appealing design.

The CSC is a dedicated centre channel loudspeaker for Dolby Pro Logic surround sound installations. It features dual 90mm Celestion mid/bass units complementing a 25mm polymer diaphragm tweeter, housed in a low profile cabinet. The CSC delivers the full range of centre channel dialog, music and effects with a generous 75 watt power handling and frequency response of 88Hz - 20kHz.

The four full-range models comprise the compact two way CS2 and CS4 bookshelf models, the two-way CS6, and the three way CS8 floor standing system featuring dual 130mm bass drivers, a 110mm mid unit and Celestion's 25mm titanium dome tweeter. Recommended retail prices range from $379 for the CSC to $1999 for a pair of CS8's.

The Celestion Shield range is available from selected hifi outlets across the country.

For further information circle 181 on the reader service coupon or contact Amber Technology, 5 Skyline Place, Frenchs Forest 2086; phone (02) 975 1211. ❖

SONY'S MDX-U1 CAR MD PLAYER

This month, Louis Challis had the opportunity to test Sony's new Mini Disc player/FM-AM car radio. O more accurately, he got to test two of them: one a boxed unit, which he was able to use for objective testin in the lab, and the other mounted in one of Sony's demo vehicles. The latter allowed him to carry out full 'hands on' subjective workout, along with other members of his family.

It was an hour before sunset, on the Friday afternoon when I drove away from my office in a shiny red station wagon. Sony Australia had lent me the car for the weekend, so that I could evaluate its sound system. Centrally mounted in the dashboard was a Sony MDX-U1 FM/AM Mini Disc Player, which was the reason why I was driving the car.

As I drove away, I admit I was a little selfconscious, as the 110-decibel peak levels at which I was playing the music were comparable to those frequently produced at the front of the Sydney Opera House Concert Hall. To generate those levels, Sony had installed an unusual array of amplifiers and loudspeakers into the station wagon's normally empty luggage tray area. The primary equipment was supplemented by two remote multi-disc CD players, a pair of large externally mounted power amplifiers, plus electronic crossovers — all of which were mounted at the rear end of the car.

Before driving off, I had loaded a prerecorded mini disc featuring the 'Festival of Orchestral Music' played by the London Symphony Orchestra (Sony SRYR 6006). I selected Rossini's 'The Barber o Seville' Overture, whose title was displayed, before putting the car into gear. I was immediately mesmerised by the dynamic realism of the music, and in particular, by the extended low frequency response. As I discovered a little later, this was provided by a large vented speaker enclosure with two 300mm drivers, which provided a substantial proportion of the concert hall's realism achieved inside the car.

Of course, what Sony had done was t

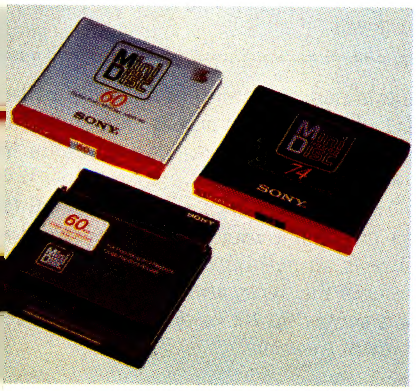
mulate some of the best features of the
emonstration cars at the Winter Con-
umer Electronics Show. It was equally
bvious that Sony's aim was to
emonstrate that not only is true hifi
chievable outside the confines of your
ving room, but if anything, it is more
eadily achievable inside a well
quipped car.

It is a little more than a year since
first saw, or heard, the Sony MDX-
1 Mini Disc player at the Winter
ES in Las Vegas. However the condi-
ons under which I listened to that first
emonstration were far from satisfactory.
ony had installed their unit inside a
pace vehicle look-alike', with
neumatic actuators 'to shake it all
bout' and thereby demonstrate its im-
unity to motion or vibration.

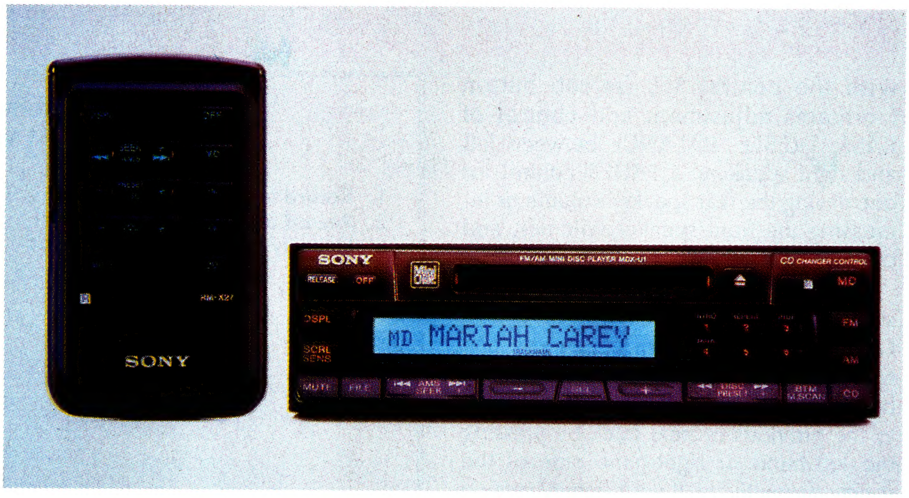
That demonstration left me
nimpressed, as the motion was far less
ggressive than you would achieve in
four wheel drive vehicle on a
umpy road.

When the editor suggested that I
eview the MDX-U1 for *EA*, I must admit
y initial thoughts (and visions) were
at I would install the system into my
wn car for its evaluation. Given suffi-
ent time to contemplate what that ac-
ally meant in terms of the complexities
d realities of the 'real world', I soon
onvinced myself that there would just
ot be enough time to follow that ap-
oach. I realised that the only sensible
pproach would be to borrow a vehicle
which the MDX-U1 was already fitted,
ith the associated amplifiers and
eakers correctly adjusted. That ap-
oach would nicely resolve the subjec-
e assessment, and the objective test
ould use a separate boxed unit.

When Sony developed the Mini Disc
stem, penetration of the mobile
ehicular) audio market constituted one
the prime avenues and pillars underpinning their marketing strategy. If ever a field cried out for the convenience of Mini Discs, then car audio is undoubtedly that field — with no tape to touch and with a disc that is so easy to insert into the slot (which Sony describes as the Mini Disc compartment).



ini discs are currently available in
oth 60 and 74 minute sizes, and in
cordable as well as pre-recorded
rm. The discs are 64mm in diameter.



One of the features of Sony's MDX-U1 car MD player is a removable front panel, designed to be taken away by the user when they leave the vehicle — to make theft less attractive. It also has a remote control unit, as you can see.

You can virtually identify the correct orientation of a disc blindfolded, and similarly poke the disc into the slot without taking your eyes off the road. There are virtually no other formats which emulate or offer either that ability, or its convenience.

A closer look

On closer examination, I discovered that the MDX-U1 contains many advanced electronic features, and it has many more functional attributes than most other new car radio systems currently offer. After examining the number of control functions outlined in the handbook, it was obvious that the controls provided were multi- functional, and fewer in number than might otherwise be expected.

The MDX-U1 comes with a remote control, so that 'back seat drivers' can control its functions without sitting in the front seat of the vehicle. However a few moments' contemplation may lead you to the same conclusion that I came to — namely, that the remote control could well prove to be a disadvantage when the kids get hold of it.

Notwithstanding, the MDX-U1 is far more likely to be operated by the driver than by the passengers (and the remote control can be removed), so accordingly the front panel controls are laid out neatly, and sensibly to satisfy the driver's primary ergonomic requirements. The most common and important controls are laid out on the right-hand side of the panel and along the bottom edge of the front panel.

The major functional control switches, starting at the upper left hand side of the front panel include the following. Firstly, a DSPL (display DATE/TIME button), which allows you to set the DATE, TIME and change the mode of the display — which will provide data on what Mini Disc is playing, the track title and the artist, as well as providing data on channel frequency and channel number when in the FM/AM radio mode or when playing a remote CD player.

The SCRL/SENS controls provide the ability to scroll the information on the LCD display, whilst a MUTE button provide the ability to mute the sound when required. For example, when there is the need to accept a telephone call, or to facilitate conversation within the vehicle.

Controls along the bottom of the front panel include FILE, which provides custom filing so that you can store the names as well as the frequencies of each radio station in the internal memory. They will then be displayed when the channel is selected.

A ROCKER button is provided for the AMS SEEK, through which the frequencies of 18 different FM stations may be memorised (six on each of FM bands 1, 2 and 3), and a further six AM stations, when the AM tuner is selected. This control is also used when listening to discs in a separate CD changer, if you are fortunate enough to have provided yourself with that facility.

The three contoured push buttons, which are centrally located on the lower edge of the front panel, provide amplification or attenuation of the sound volume, and when used in connection with the central SEL (select) button facilitates adjustment and control of BASS, TREBLE, BALANCE between left and right speakers, a FADER control for decreasing the rear speaker volume or increasing the front speaker volumes, and of course back to volume.

To the right of these is another rocker switch for DISC (MANUAL SEARCH/ DISC SEARCH), through which you can rapid FORWARD or REVERSE to the beginning of the current track, or move to the previous or next track by pressing the left-hand or right-hand side of the rocker respectively. If your finger stays on the rocker switch, then it provides the added function of a 'FAST REVERSE' or 'FAST FORWARD' control.

Along the right-hand side of the front panel are four switches, the top one being a large MD switch, which when pushed activates the Mini Disc PLAY mode. Below this is an FM button for selecting one of the three FM bands, and below this again is the AM switch for selecting the AM tuner. At the bottom right hand corner is a CD button which will activate a separate CD player if one is connected.

There are six small pushbuttons centrally located to the right of the LCD display. These are labelled INTRO, REPEAT and SHUF in the upper row, with INTRO standing for INTROSCAN, which facilitates searching of the desired track by listening to the first 10 seconds of each track. The REPEAT button facilitates replay of that particular track when playing a Mini Disc, and the track will be repetitively played until the REPEAT button is pressed once more. The SHUF button will randomly play every track on the disc (i.e., in a different order from that on the disc).

The three buttons in the bottom row provide special functions, which relatively few people will find the need or justification to use. The BANK button is used when selected tracks have been identified and recorded on a given disc in a remote multi-disc CD player. The second last button is pressed in conjunction with SELECT, to erase the title of the CD disc; and the final button, if pressed in conjunction with the SEL button, mutes the beep tone which otherwise signifies the pressing of a button, as well as for the more critical warning of the need to remove the unit's face plate when leaving the vehicle.

Two other controls are provided, one being an EJECT button to the right of the Mini Disc compartment, and a RELEASE button at the extreme upper right-hand end of the control panel. When pressed, this releases the front panel; the owner or driver can then slip it into the little plastic carrying case provided for that purpose, and thereby ostensibly either foil or at least discourage the unit's premature theft.

Measured performance of Sony MDX-U1
FM/AM Mini Disc Player

1. **Record to replay** Frequency response 10Hz to 20kHz+0.1, -1.38dB
2. **Record to replay**
Linearity from clipping level

Nominal Level	**L. Output**
0db	0.0
-0.1	-1.0
-3.0	-3.0
-6.0	-6.0
-10.0	-10.0
-20.0	-20.0
-30.0	-30.0
-40.0	-40.0
-50.0	-50.0
-60.0	-60.8
-70.0	-70.0
-80.0	-80.0
-90.0	-91.0

3. **Channel separation**

Frequency	**Right into Left dB**	**Left into Right dB**
100Hz	-71.7	-73.5
1kHz	-77.5	-65.5
6.3kHz	-65.1	-52.0
10kHz	-60.3	-48.2
20kHz	-66.1	-45.7

4. **Distortion @ 1kHz**

Level	**2nd**	**3rd**	**4th**	**5th**	**THD%**
0	-85.7	-	-	-	0.0052
-20	-73.8	-	-	-	0.02
-30	-82.9	-	-	-	0.0072
-50	-54.0	-56.5	-	-57.1	0.28
-60	-23.0	-29.4	-	-36.5	8.0
-70	29.4	-	-	33.1	4.1
-80	-	-	-	-	Noise limited
-90		-	-	-	- Noise Limited

Distortion at -10dB for specified frequencies

Level	**2nd Harmonic**	**THD%**
100Hz	59.6	0.1
6.3kHz	64.5	0.06
10kHz	61.1	0.09

5. **Signal to noise ratio** 78.8dB(lin) 83.0dB(A)
6. **FM sensitivity**

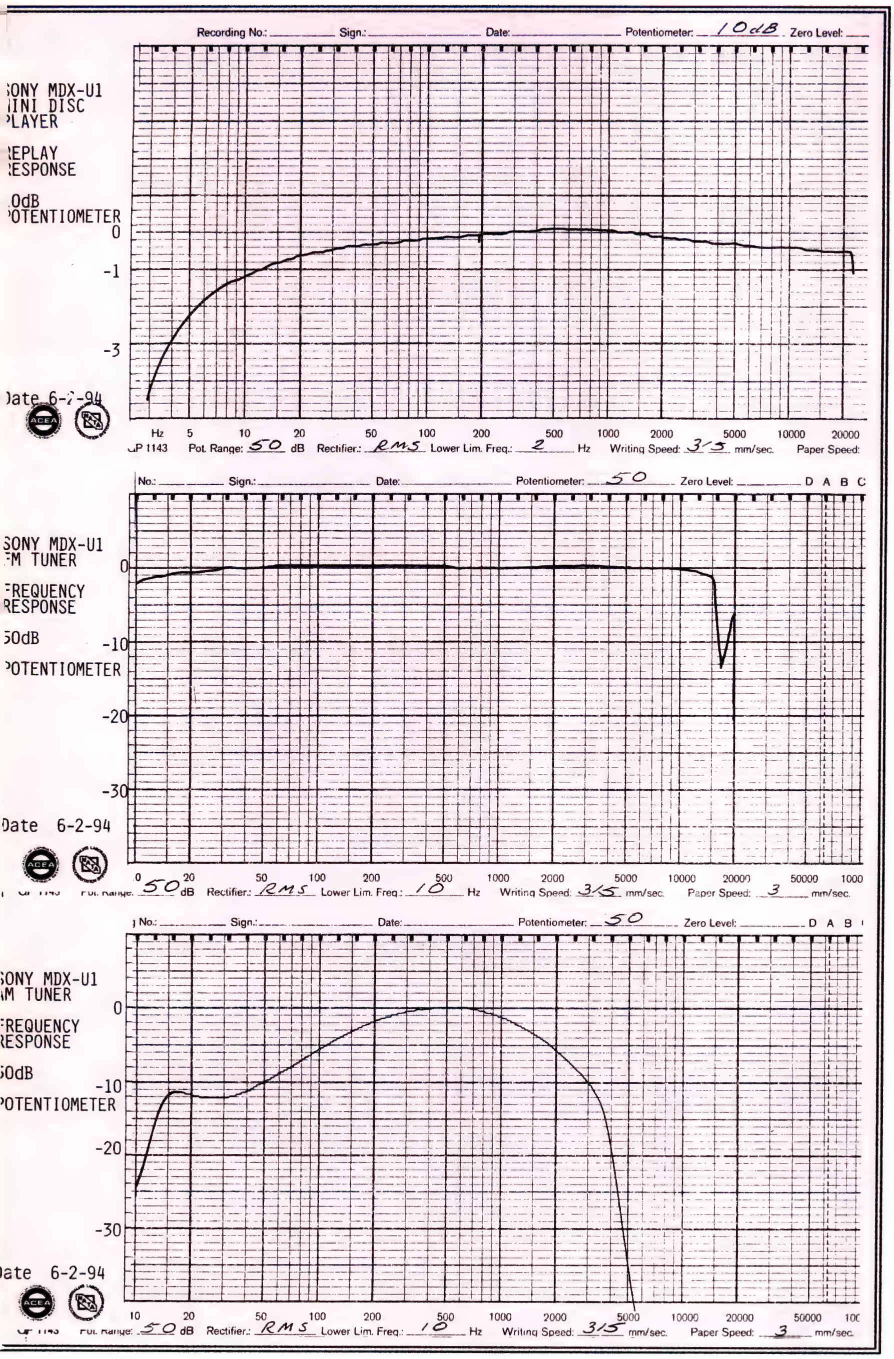
for 50dB quieting	15.4dBf
Channel Separation @ 1kHz	32.2dB
Selectivity Adjacent Channel	21.3dB
Frequency response	30Hz to 15kHz +0.3, -2.6dB

An examination of the MDX-U1's rear reveals a mass of input and output cables, neatly labelled as FRONT and REAR stereo outputs, a UNILINK stereo input for connection to a Sony CDX-U300 or similar multi-disc CD player, and a UNILINK control cable input for automated and simplified control of th CD player (or *players*, as exemplified b the station wagon provided to me for m subjective evaluation).

The MDX-U1 incorporates a small fa on the rear panel for internal coolin This is something of a rarity among units of this type, and I have no doubt was proved to be essential in the hotte parts of Australia.

The objective tests

My objective evaluation of the MD U1 was performed on a boxed new un and I experienced relatively few difficu



hese measured frequency response plots for the MDX-U1 show (top to bottom) e mini disc player, FM tuner and AM tuner performance. Note that the top curve plotted with an expanded scale — to make the small variations more visible.

es in activating and testing its electro-coustic and related RF parameters. One oblem that did cause me some anguish as Sony's inability to provide me with appropriate reference test Mini Discs. ortunately, I had previously produced y own test discs in expectation of just ich a problem.

The Mini Disc player has a replay freuency response which, although flatter an required for automotive applicaons, is not quite as good as the frequen response displayed by some of the ortable Mini Disc players that I have previously evaluated. The frequency response droops down to -1.3dB at 10Hz, and the -3dB point occurs at 4Hz. At the top end, the frequency response is down by 0.5dB at 20kHz, which puts almost all car cassette recorders to shame. This frequency response surpasses what would ever conceivably be required in a car, as the loudspeakers will always constitute the primary limiting factor.

To provide that additional 'grist for the mill', I also evaluated the frequency response of the FM tuner and the AM tuner sections of the receiver. The FM tuner's response was very smooth, and appropriately flat right across the spectrum to 15kHz. At 16kHz, the stereo pilot tone decoder's notch filter sharply cuts out the unwanted pilot tone components, so the FM tuner is effectively limited to a 15kHz bandwidth.

Whilst the FM tuner has a wideband response, the AM tuner has a typical nondescript frequency response: 10dB down at 55Hz and 10dB down at 2.3kHz.

As you may appreciate, the AM band is regarded as a low fidelity communication medium in Japan, and regretfully now appears to be similarly regarded by the Australian Regulatory Authorities.

The FM sensitivity of the receiver was excellent and the 50dB quieting sensitivity with a 75 ohm input was 15.4dBf. The channel separation at 1kHz was 32.2dB, which was quite reasonable. The frequency response on FM without the high-pass filter activator was 30Hz to 15kHz (+0.3dB and -2.6dB), and was true high fidelity.

As the prime feature of the MDX-U1 is its Mini Disc player, I spent more than the usual amount of time assessing the adequacy of the relevant performance parameters. The replay linearity was excellent down to -50dB, then showed a slight glitch in its transfer characteristics at -60dB, but continued to display impeccable figures down to -80dB, whilst it was only 1dB low at - 90dB.

The channel separation figures were superlative at 100Hz and 1kHz, but displayed a slow and gentle drift of the left channel into the right at the 6.3kHz test frequency and above.

Because of the ATRAC compression system, the distortion figures are excellent all the way down to -30dB, but start rising between -30dB and -50dB. By the time the level drops to -60dB, the distortion figures are relatively high, and progressively deteriorate thereafter. When using a data compression system like ATRAC, whose characteristics are distinctly non-linear, I guess those sort of characteristics are part of the price you have to pay.

The unweighted signal to noise ratio of 78.8dB is commendable, whilst the A-weighted signal to noise ratio of 83dB(A) is still reasonable. Those performance figures may well have been bettered had I been using Sony's own OEM Test Software, which I was unable to obtain for the review.

The overall objective performance of the MDX-U1 may be classified as being excellent for the Mini Disc Player section, excellent for the FM tuner, and no better than average for the AM tuner. The control functions however, as I will recount, were first class, and particularly the ability to control bass, treble and boost, and the associated settings of volume and front-to-back sound ratio.

Subjective testing

The subjective evaluation of the MDX-U1 proved to be far more pleasant and exciting than I might have guessed, when I tacitly requested somebody else's vehicle with the tuner installed. During the weekend, I had cause to take numerous members of my family to various functions, with the longest journey being more than one hour duration. Of course everybody in the car had their own choice of music, and satisfying those choices proved to be a trifle difficult.

The choice was limited to my own previous Mini Disc recordings, which included operas and specially selected demonstration music, together with the London Symphony Orchestra with a potpourri of classical music, in the previous mentioned 'Festival of Orchestral Music' disc. Other discs with which I was provided included 'Living Colour Vivid' (Epic 44099), the Labeque Twins in 'Love of Colours' (Sony SM 47227), and last but not least, a Mini Disc with a relatively old Billy Joel album of delightfulmusic.

As I soon discovered, the number of controls that I actually needed to use, to achieve normal functionality, was limited to just seven — excluding the front panel RELEASE button. Those seven controls gave me complete control of AM/FM and Mini Disc selection and control functions.

I also evaluated the benefits of the attached CD player, and that added one extra button to the seven listed above. I quickly learned to use those eight buttons without needing to look at the front panel and take my eyes of the road. I soon realised that the MDX-U1, when appropriately formatted with amplifiers and good speakers, is a delight to use and an even greater delight to listen to.

One of its neat and endearing features is an unexpected audible one. When you switch off the ignition prior to leaving the vehicle, the MDX-U1 sweetly beeps at you and reminds you with what is in effect a very gentle warning signal that you have not detached the front panel. That nice little feature was only one of many that endeared the MDX-U1 to me, and only added to a feeling of total capability for what is after all a relatively expensive mobile hifi system.

Each of my passengers and were impressed by the clarity ar dynamic range of the sound, and I the quality of the pre- recorded musi The one and possibly the only catch that the cost of installing a bas system of MDX-U1, twin stere amplifiers and speakers will set yc back at least $2500 — and conceivab as much as $4000 if you seek the u timate in quality.

When faced by those sort of prices, tl less affluent readers and members of tl public are no doubt likely to cough di creetly and quietly withdraw from tl dealer's showroom. With prices of th magnitude, there are likely to be a rel tively small number of MDX-U1's beir sold in Australia.

Notwithstanding, the MDX-U1 is a outstanding piece of high fidelity equi ment. If it weren't for that AM tuner, would have come away with five stars c its report card.

Physically the MDX-U1 measure 50mm high by 178mm wide by 170m deep, and weighs only 1.3kg. The MD U1 FM/AM Mini Disc unit itself has a RRP of $1999.

Further information should be avai able from Sony dealers, or from Sor Australia, 33-39 Talavera Road, Nor Ryde 2113; phone (02) 887 6666. ❖

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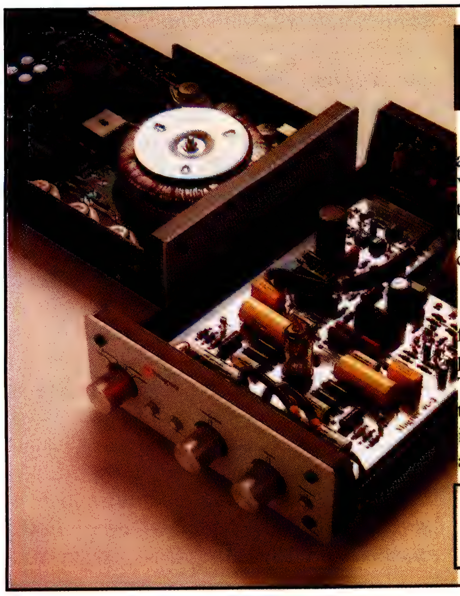

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The **Magnet MA-3** is a 120 watt rms/ch into 8-ohms stereo amplifier. The circuit is based on a fully complimentary symmetrical push-pull design with direct coupling between stages. the input and pre-drive stages use JFET cascode with BJT to give a very wide frequency response up to 180KHz. The output uses two pairs of transistors per channel to give continuous high output. The MA-3 uses a toroidal transformer to supply high power and to reduce the interference. A DC fault protection circuit is fitted to protect itself and the speakers. The MA-3 uses 1% metal film resistors, WIMA capacitors and Monster cable.

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READER INFO NO. 3

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- Manual/Auto Ranging
- 10A current

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- 0.5% accuracy
- 41 segment bargraph
- 20A current
- Memory offset
- Water resisitant
- Data Hold
- Holster

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- 4 1/2 digit mode
- 1ms peak min/max recording
- 0.1% accuracy
- True rms
- Analog pointer
- Backlight
- 20kHz bandwidth
- Holster

$695*

Appa 23

- Automotive
- Large display
- Dwell
- Tacho
- Duty cycle
- 0.5% accuracy
- Auto power-off
- Water resistant
- 15A current

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Pantec 50XT

- High sensitivity 50kΩ/V
- 36 ranges
- 2.5% accuracy
- Continuity buzzer
- Capacitance
- Carry case

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Fluke 21/75-II

- 0.4% dc accuracy
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- 3 current ranges

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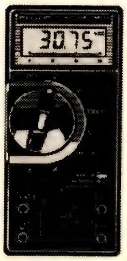

Pantec 2035

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- 200μA/10A current
- Capacitance
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- -18°C to 260°C range
- ±3% accuracy
- 1mV/°C or °F output
- 4: 1 ratio of distance to spot diameter
- Sleep mode

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Appa 98

- 3 1/2 digit
- 0.5% accuracy
- Frequency
- Capacitance
- 41 segment bargraph
- Memory offset
- Holster

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- 40μA movement
- Diode test
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READER INFO NO. 6

An update on the technology behind

THE 'CURRENT' PUSH IN ELECTRIC VEHICLES - 1

It seems that something new about electric vehicles is appearing in the news on a fairly regular basis these days. Quite apart from the recent Solar Challenge race, most vehicle manufacturers have been displaying EV concepts and prototypes at recent motor shows around the world — proving that this is definitely an emerging trend in motor vehicle propulsion. In this series of two articles, the author explains some of the reasons behind this upsurge of activity and discusses some recent developments in electric vehicles (EV's).

by PETER KILLIN

First, a little history. There is nothing new about EV's; they have been around for a very long time. For example, the first battery powered EV appeared in 1837. At the turn of the century, there were more EV's on American roads than petrol powered vehicles.

Henry Ford's wife, Clara, had an electric runabout in 1922, and milk deliveries in England have been carried out using EV's since WW2. Don't forget also that man put an EV on the moon over 20 years ago (a large step of the motoring kind?).

It seems though, that getting EV's back onto the road for the average motorist will take a lot more work than it took to get one to the moon. While the 'moon buggy' was built with seemingly unrestricted resources and received support from most, the general feeling is that EV's may not 'take off' at all this time round. It is expected that even the most dedicated of conservationists may find the extra cost of purchasing and operating an earth-bound 'green mobile' to be an insurmountable barrier.

Oh, by the way, it won't take long for you to realise that this discussion will be centred primarily around events taking place in far-off California. It is difficult to discuss any trends in the automotive industry without starting in the smog capital of the US of A. Whether we like the idea or not, what happens over there (amongst the 'Big Three' — GM, Ford and Chrysler), will affect the rest of the world; including us, in time.

To encourage the use of electric vehicles, the south German town of Memmingen has built a computer controlled 'solar filling station'. A solar array converts sunlight into current to charge electric vehicle batteries.

If we ever expect to see EV's on the road in any quantity, they will almost certainly have to be developed and produced by a major manufacturer.

To prove the point, Australia's current emission regulations (ADR 37), are modelled very closely on standards and procedures set in California some years back.

The EV push

The governing body causing all this momentum is the California Air Resources Board, or 'CARB'. This organisation is empowered by the EPA to write 'clean air' regulations for California (assuming it isn't too late).

The particular CARB regulation that is driving the latest EV movements is one that requires '2% of all cars sold in California in 1998 to emit no harmful emissions'. This rule applies only to manufacturers which sell more than 35,000 vehicles each year in that state.

As well as creating major headaches for vehicle manufacturers, this new rule has produced a new term: 'zero emission vehicles', or ZEV's for short.

The mandate of *zero* emission for 2% of vehicles is a bigger one than we back here in Oz may realise. Even though California is only one state out of 50, this one state represents 10% of the total US car market. So the 2% rule will require manufacturers to produce and

CALIFORNIA EMISSION REQUIREMENTS

Implementation rates for conventional vehicles, TLEVs, LEVs, ULEVs, and AEVs used to calculate fleet average standard for passenger cars in California.

Model year	0.39 grams per mile	0.25 grams per mile	TLEV 0.125 grams per mile	LEV 0.075 grams per mile	ULEV 0.040 grams per mile	ZEV* 0.00 grams per mile
1994	10%	80%	10%	—	—	—
1995	—	85	15	—	—	—
1996	—	80	20	—	—	—
1997	—	73	—	25%	2%	—
1998	—	48	—	48	2	2%
1999	—	23	—	73	2	2
2000	—	—	—	96	2	2
2001	—	—	—	90	5	5
2002	—	—	—	85	10	5
2003	—	—	—	75	15	10

Note: TLEV = transitional-low-emission vehicles; LEV = low-emission vehicles; ULEV = ultra-low-emission vehicles; ZEV = zero-emission vehicles

*The percentage requirements for ZEVs are mandatory.

Source: California Air Resource Board

ig.1: The schedule for vehicle emission requirements hich has been published by the California Air Resource oard (CARB). Note the ZEV column at far right.

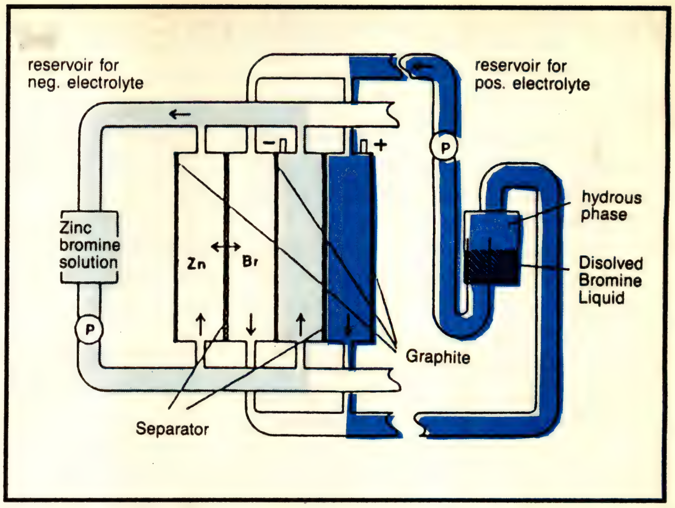


Fig.2: One of the improved types of battery being developed for electric vehicles is the zinc-bromine type.

nake available for purchase around 0,000 ZEV's in California in 1998.

Whilst CARB does not specify an ngine of any particular type, effectively ZEV' means electric vehicles. Even hough there have been certain petrol ngines produced which emit less HC nd CO than the ambient air in Los ngeles, as clean as they are these engines still do not comply with the 2% ZEV mandate.

Actually the CARB requirements are little more complex than the first statement reveals. The chart shown in Fig.1 ists the agenda of tightening rules. The nost relevant are that ZEV production nust rise to 5% by the year 2001, and hen to 10% by 2003. After 2003 maller volume manufacturers (less than 5,000 pa), will also be required to roduce ZEV's. Seventeen other US tates are considering the ZEV mandate lso, but the major manufacturers are ery busy mounting legal proceedings n order to slow down the spread of the readed '2% epidemic'.

These rules assume that car makers vill absorb the inevitable losses on ZEV's, to protect the other 98% of their business. The more cars they sell, the more money they lose. It has been estimated that, with present technology, this could mean a loss of around $20,000 per vehicle.

Pollution transfer?

To many, forcing the use of EV's is simply transferring the pollution from one place to another — from the city streets and freeways to the areas that house electric power stations.

It has been suggested by others that electric power stations are at least twice as efficient in converting energy as the internal combustion (IC) engine. Added to this is the claim that there is at least a 15% energy loss during the refining process at oil refineries, giving a further loss in conversion efficiency. These factors lead pro-EV people to make the claim that:

Overall emissions would be halved if electricity was used to fuel motor vehicles instead of IC engines.

(I reckon this would be because more people would walk!)

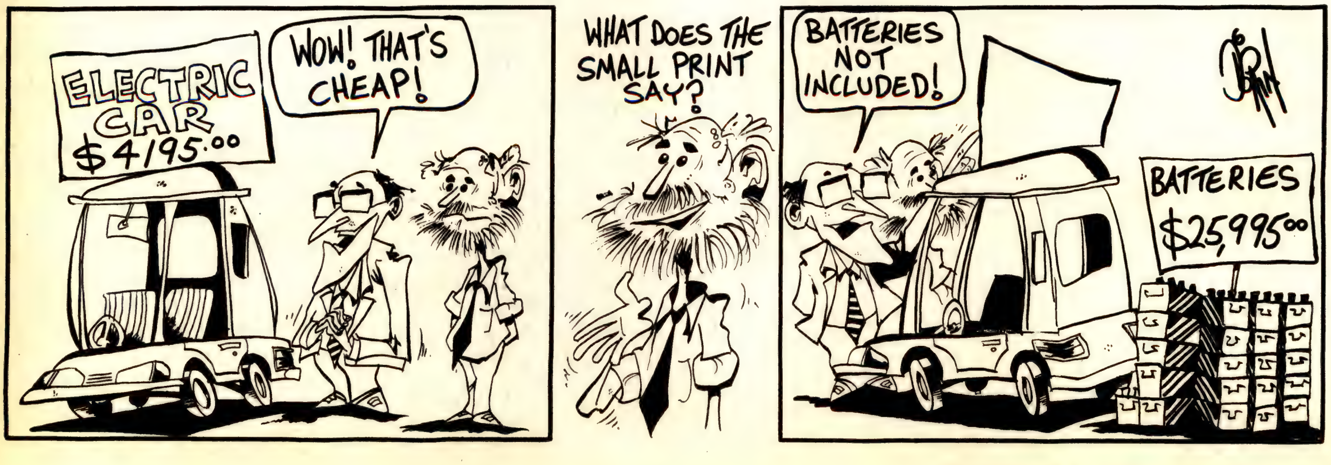
Increased EV use would obviously reduce the reliance on imported oil, with the added benefit of lowering the potential for oil spills and other environmentally hazardous events. That bit does sound pretty good!

The marketplace

Taken overall, the consumer is a bit of a strange creature. Whilst on one hand wanting to protect the environment, many will not accept that there is a cost that goes with that good desire. Recent research carried out in the USA by GM shows that customers are not willing to pay a premium for environmentaly safer products.

Experts estimate the average penalty added to the purchase price of an EV (in the early years after they become widely available), will be from US$5000 to $10,000 more than a comparable petrol vehicle.

In contrast, many potential EV customers believe they should pay *less* for an EV, because it is not as versatile as vehicles they have been used to for decades. There are fewer parts: no en-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gine, fuel and exhaust systems or other complexities, so it should be less expensive to own and operate! Then there is the added inconvenience of constant recharging.

What these consumers don't recognise is that these vehicles are part of an emerging technology, and use more expensive materials like aluminium, magnesium and rare earths.

While American car owners expect to pay, on average, US$16,600 for their next new 'petrol polluter', they would only be prepared to pay around $14,200 for an EV with a top speed of just over 100 kph and a range of only 160 kilometres.

(Remember, these are US prices and you can add on around $12,000 to equate to our prices!)

Limitations of EV's

The main problem with EV's is the distance they can travel before performance goes a 'little flat'. On average, EV's built with today's technology can only travel about 100 kilometres before the batteries run out of energy. And this is basically due to the limited storage capacity/weight ratio of current batteries.

In order to increase EV range to an acceptable level, many new types of batteries are under development. These batteries are looking very different to the good old lead/acid type that we are so familiar with. You won't be able to holler for just a Marshall any more — you'll need all his deputies as well!

Whilst these 'new batteries' all have the same three basic cell components (positive plate, negative plate and electrolyte), they take on different forms, such as a solid electrolyte in some cases or a pump to circulate hot or molten electrolyte in others.

It is very clear, however, that a major breakthrough in battery technology is required to get EV's really charged up and running.

The Big Three carmakers have formed the US Advanced Battery Consortium or 'USABC', to pool their resources and accelerate the development of new battery technology.

The USABC has a short term goal (by 1998), to produce a practical battery which will last for five years, cost about US$6000 to purchase and will run a vehicle at a cost of 1.6 cents per kilometre for electricity (recharging costs). It also has a longer-term goal to produce a battery with around three times the energy storage capacity, at an even lower purchase price of $4000.

From this you can see that at present, when the cost of periodic replacement of the battery is added to the cost of the vehicle, an EV does not come close to being competitive with conventional petrol vehicle operation.

Types of EV batteries

Traditional lead/acid batteries are said to have (by weight), about one-hundredth the energy content of petrol — yielding a very short range for the petrol-less carriage.

While some EV development is still being carried out using lead/acid batteries, there are quite a number of new batteries receiving a lot of development attention, some of the main players are:

Lithium polymer
Molten lithium/metal sulphide
Sodium/sulphur
Nickel/metal hydride
Nickel/cadmium
Zinc/bromine

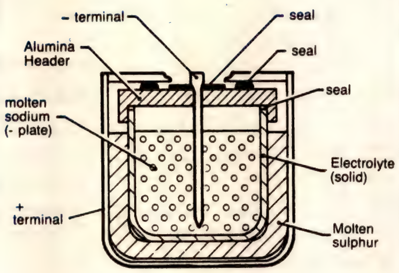

Fig.3: Another type of battery with higher energy density is the sodium-sulphur type.

To give an example of the differences in some of these batteries, where a lead/acid type may provide a given vehicle with say a 50 kilometre range, the nickel/cadmium would provide around 80 - 100km and the sodium/sulphur around 160km.

As mentioned previously, all of these batteries use the three basic cell components. For example, the molten lithium/metal sulphide battery uses pressed metal powders of lithium alloy as a negative plate and a metal sulphide as the positive plate. A 400°C mixture of magnesium oxide and lithium salts forms the electrolyte (forget your hydrometer for this one!).

To obtain the greatest life from most batteries, it is important that they are discharged to around the 80% mark before being recharged. Electronic systems which can monitor battery charge effectively will be necessary to ensure satisfactory battery life.

Another important issue is that of recycling old batteries. Many of the components that make up these batteries will be suitable for recycling, but there may be health hazards associated with some of them. This one will have to be watched carefully.

There are some additional ways of on-board energy storage other than the batteries described so far. The secret to efficient energy storage, according to one NASA scientist, is in the use of flywheel systems. In fact, a number of major manufacturers are currently undertaking some research on this.

A flywheel system consists of a carbon-fibre flywheel, spinning silently at 100,000rpm on frictionless electromagnetic bearings. The flywheel would be around 500mm in diameter and housed in a 'cake pan' shaped vacuum chamber. The flywheel is set spinning by applying an external source of energy, such as an electric motor. Once the flywheel is spinning, its stored energy may be used to drive an on-board generator which powers the electric motor.

One such project under development could allow 'flywheel batteries' to have a range of up to 1000 kilometres and be almost infinitely rechargeable. This sort of technology has been around for a long time and has been used on the Space Shuttle and Skylab.

Another potential storage medium is the capacitor. A large capacitor could store enormous amounts of electrical energy, which could then be fed into an electric motor to provide motion.

There is a lot more work to be done in these areas before any of these solutions become practical for EV use.

To assist in increasing EV range, attention has also been focused at the parasitic loads placed on a vehicle. For example how do you light, heat and air condition such a car, where the battery is already heavily taxed by electrical load?

A lot of research is being carried out to help in this area.

Electric motors

Up until the early 1970's, most EV's used DC motors. These are being replaced by AC motors, particularly the permanent magnet type. With this type of motor, the range of an EV is something like doubled and acceleration is dramatically improved.

Regenerative braking

Regenerative braking simply means the electric motor that drives the EV becomes a generator and slows the vehicle down when the brakes are applied. It has been suggested that this system recovers around 10 - 15% of the total energy consumed by an EV.

Power conversion

Recent breakthroughs in high power switching electronics have made both electric and hybrid vehicles more viable. Of particular importance have been electronics that allow power from DC batteries to be efficiently converted to AC to drive more efficient AC motors.

Lighting

Gas discharge headlamps use 40% less electrical energy than conventional halogen types, and generate four times the amount of light. LED's will also find more use for various applications, such as tail lights, due to their very low energy consumption.

Cooling

Solar panels can be used for various functions, such as to power a fan that pushes hot air out of the cabin.

Efficient air conditioning systems are necessary for these vehicles. The type of A/C system fitted to petrol vehicles would reduce an EV's range by around 50%. An efficient solar or electrical system is required, one which will reduce this range drop to only 5% or so. More work is required on this one.

Heating

Early in 1993, CARB agreed to allow fuel-burning heaters in ZEV's. There are two conditions for their use. The first one is that it can only operate when the outside temperature is below 4.5°C; secondly, the system must not produce any evaporative emissions. This agreement has pleased car makers, and will help eliminate some of the loads placed on the batteries. So much for 'totally zero' emissions, though!

Much work is being done investigating different means of constructing vehicles using lighter materials, with aluminium being predominant. Other areas to reduce energy consumption are the development of a new generation of low rolling resistance tyres, and continuing improvements in aerodynamics.

In the second of these articles, we'll look at the main types of EV's which have evolved to date, and some examples of each type.

(To be continued.) ❖

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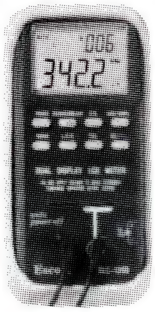

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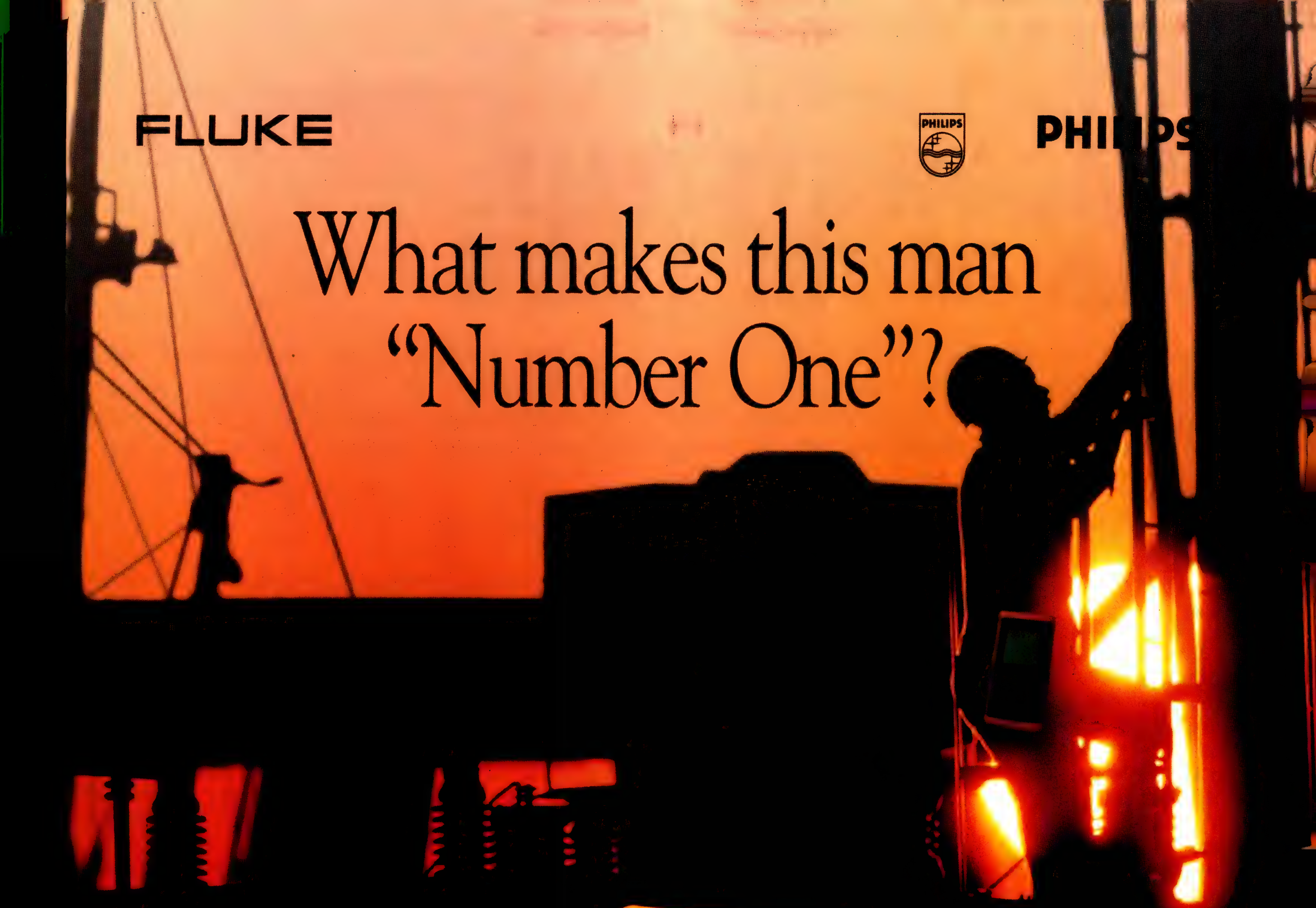

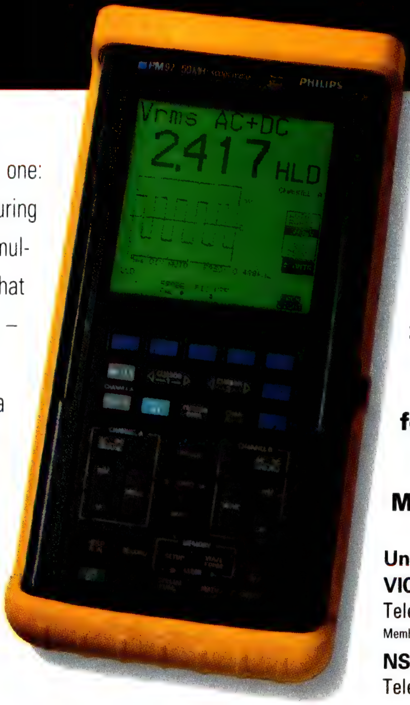

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READER INFO NO. 7

Small firm's breakthrough in speech recognition:

DRAGON SYSTEMS: TALK OF THE TOWN

Despite the predictions of experts only a few years ago that practical speech recognition systems were many years away, they are now not only practical but commercial — and running on personal computers. In fact the products developed by market leader Dragon Systems, a small firm based near Boston, Massachusetts are now being used with great success by users around the world — including Australia.

by PAUL HENDY

In 1916, electrical engineer Nikola Tesla looked into the future and prophecised voice-operated typewriters to alleviate the toil and drudgery of business communications. Today, the most powerful of computer technologies have arrived — speech recognition (SR) systems — and they are set to revolutionise the way we interact with computers, databases, robots and machines, transport and communications infrastructure. Already they're having an impact in many commercial and public service enterprises where voice is commonly and repetitively used.

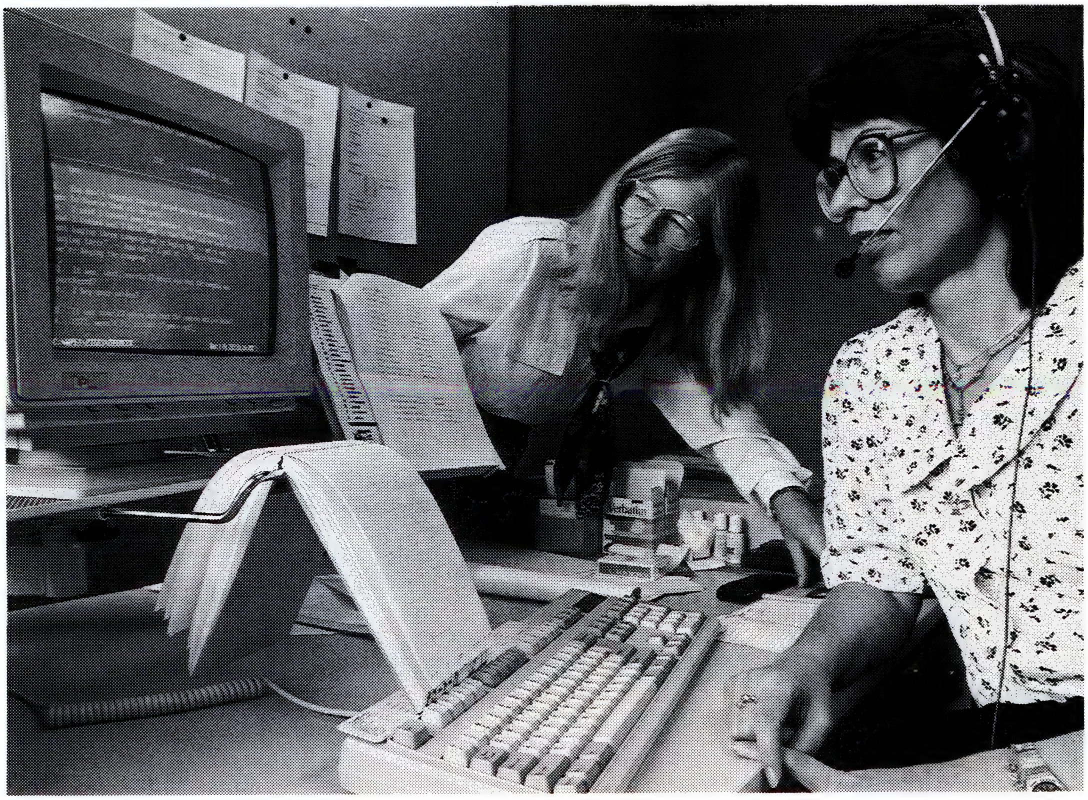
Speech, after all, is the preferred communication medium for a global population. Speech systems allow executives, the public, and also an older retraining workforce and disabled community who have never used computers to join the information age. The reward for researchers, investors and developers is a new billion dollar marketplace of client-server products, exports and services.

For 860,000 Australian small businesses, speech systems might just be the breakthrough needed to compete commercially with Asia, to increase productivity and efficiency while significantly reducing operating costs.

Key player in this field is Dragon Systems Inc — a small Boston research company whose state-of-the-art products give listening and speech understanding capabilities to computer and automation technology.

In the last three years, Dragon has become so powerful and the voice vision so pervasive and diverse that computer giants IBM, Apple, and more recently Microsoft have been forced to sign licensing agreements with Dragon. This is because the small company has forged an estimated five to seven year technology lead over the big research laboratories.

Bill Gates of Microsoft, who has caught the 'look who's talking' bug, attempted to buy out Dragon recently and



Court reporters Sheila Rattray (left) and Jackie Taylor (right) demonstrating Dragon Dictate at the Downing Centre in Sydney. (Photo courtesy of the Department of Courts Administration, NSW.)

failed. But he is quoted as saying that "if you want to know where to put your millions and millions of system dollars, you should use your own body as a guide — speech, listening, handwriting, touch — its totally predictable that these are the key technologies (for the future)".

Graham Reynolds, Managing Director of Australia's Auscript, the Federal Government's national reporting service, has likewise been smitten by the power and potential of speech technologies after a visit to the Dragon's liar.

In a partnership with Digital Technologies Pty Ltd, a Perth company that has acquired the marketing and selling rights to Dragon's products, Reynolds is promoting the aurally-attentive, 'hands-free' technology to the legal and reporting professions — and also numerous commercial users.

"They become your total interface with the computer", he says. "And once people realise the cost savings and efficiencies to be made in the generation and handling of documents and information, not only for large companies and agencies but small businesses, they will be queuing outside the door for the technology."

Hands off!

Adjust the microphone, fold your arms, and begin: "Voice console, wake up, start Word Perfect, begin document..." The power of the pen (and keyboard) is being replaced by the power of the voice, and the popular A$8000 package 'DragonDictate-30K' can do a tireless and accurate 50 words per minute, which is a revolutionary thought for busy offices of two-fingered staff and for companies that share secretaries — or would like one.

Ray Stata, chairman/CEO of Analog Devices, and Janet Baker, president of Dragon Systems, congratulate each other on news of President Clinton's announcement of the companies winning a Technology Reinvestment award.

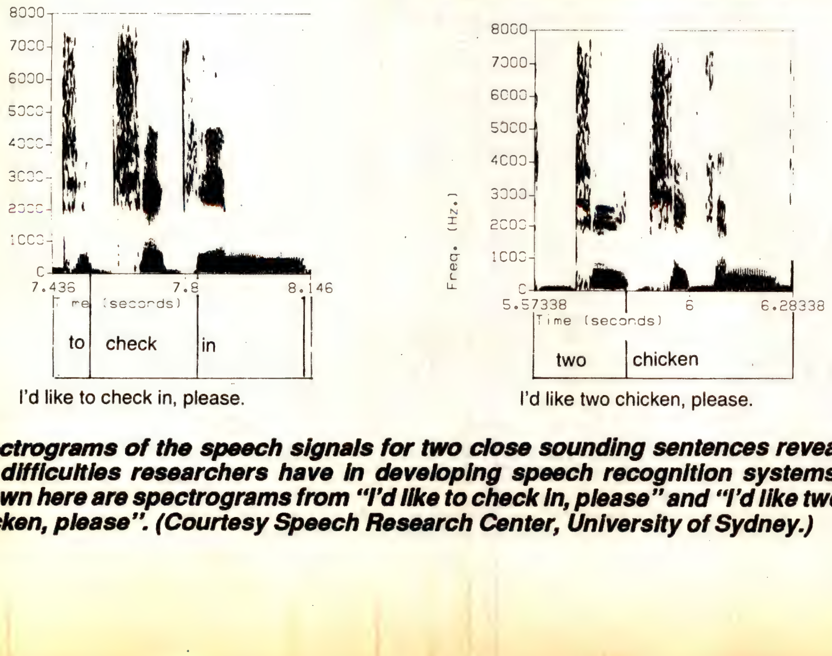
Prices, availability

At the time of writing, the purchase price of Version 2.0 of Dragon Dictate30K was A$4000 per system, including installation and training. A new product called the Dragon Dictate5K Starter Edition had also been released, offering a scaled-down vocabulary of 5000 words compared with the larger 30K product, priced at A$1000 (software only).

Due for release in March 1994 is Version 3.0 of Dragon Dictate30K, which will have a 'meaning in context' facility to cope with seemingly nonsense sentences like "write a letter at the right time to Mr Wright".

A version for Microsoft *Windows* is expected by mid 1994. Also the Macintosh version of Dragon Dictate30K is expected to be released in 'Beta' customer trial form, in March 1994.

Further information on Dragon Systems products is available from the General Manager, Auscript, Level 17, Law Courts Building, Queens Square, Sydney 2000; phone (02) 230 8252.



I'd like to check in, please.

I'd like two chicken, please.

Spectrograms of the speech signals for two close sounding sentences reveal the difficulties researchers have in developing speech recognition systems. Shown here are spectrograms from "I'd like to check in, please" and "I'd like two chicken, please". (Courtesy Speech Research Center, University of Sydney.)

Reynolds says "it's a much more natural human process to be communicating through speech, rather than using any mechanical means".

The Dragon system comprises a headset microphone, a sound card, and a software program which runs an active 25,000 word vocabulary. The system also searches an 80,000 word reference dictionary from Random House, if it cannot recognise a spoken word to find a better match.

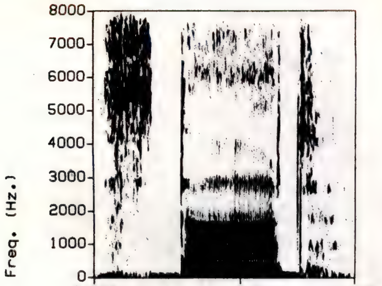
One drawback is that Dictate-30 is only a near-continuous speech system, which must have a 1/4 to 1/10th of a second pause between words to allow it to function effectively. However, according to David Horwitz, Auscript's information technology systems manager who is tuning the technology to Australian user conditions, Dragon can be tuned to 'really fly' on a 486 computer.

After the smart software has recognised the user's verbal signatures — their 'phonemes' and phrasing patterns — usually after some 2000 spoken words or 10 pages of voiced-text, Dragon matches the average typist.

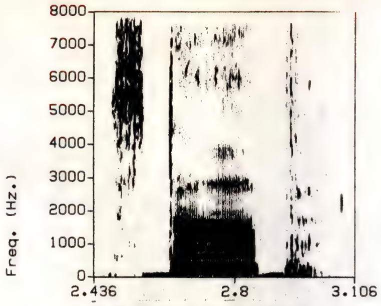
Court reporting

One of Graham Reynold's first trialing customers has been paper- amassing giant the NSW State Reporting Service, which is required to churn out 4000 pages of transcript a day from 100 courts across the State covering industrial to admiralty to criminal matters. Two pen writers, who would normally dictate their court shorthand notes to professional typists capable of 80 to 100wpm and six to seven-and-a-half pages of transcript per hour on average,

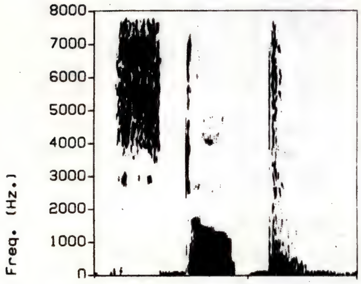
Dragon Systems: Talk of the Town



start (Australian speaker)



stop (American speaker)



stop (Australian speaker)

University of Sydney researchers have also supplied spectrograms of the speech for "start" and "stop" in different accents — showing the challenge to design voice recognition technologies which are speaker independent. An American speaker's "stop" is surprisingly similar to an Australian's "start", and rather different from an Australian's "stop".

have been putting Dragon through its paces over the last four months.

The machine doesn't recognise expletives, and has occasional difficulty with short words and monosyllabic vowels like confusing 'get' with 'it' and putting 'they' for 'a'. But Jenny Davis, the Court Reporting Manager, says the trial has been successful in this 'ultimate test' of pitting a machine against 'a highly skilled person'. The pen writers have been producing on average five to six pages of script an hour.

Reporting Services Director, Trevor Stacey, predicts savings of $900,000 a year for his department in labour cost savings, where Dragon can replace contract secretaries and reduce retraining costs of some pen reporters on a more complex real-time CAT (computer-assisted transcription) system.

"In terms of cost savings and benefits in all parts of Government, the wider application is enormous. What we are doing here is creating interest even in the USA", he says. Jenny Davis adds "we will have to start charging admission fees for those who want to see the Dragons at work, the interest has been that great".

General office work

However, the Dragons find a natural home in the general office environment, where typing speed for throughput is never the prime production criterion as it is at SRS. Reynolds recommended to solicitor Ian Shivers that the technology might be useful for a large writing project for a client. Initially Shivers thought that his own 'reasonably good' keyboard skills of 50wpm were no justification for any personal use of a Dragon, but soon found it was ideally suited to his work environment — and "excellent for those 700-page projects and for producing big slabs of text in reports".

Shivers says that the "really excellent thing about it is that I can get a much better flow from the head to text. There is no intervening process — what I'm saying, I'm seeing (on the screen), and immediately confirming that it's correct." Now he uses Dragon daily.

London lawyer Michael Pettman, who is promoting Dragon systems in t United Kingdom, told Reynolds that now looks forward to Mondays b cause the work that was previously di tated to secretaries the previous we and which was always on his desk o Mondays for checking, perhaps retypi and rechecking, is now a thing of t past. He now dictates straight to Drag and adds that his US$9000 Americ Dragon (far less than a secretary's a nual salary) paid "for itself in o year". But his greatest satisfaction is gaining control of his environment.

Darcy Readman of the Law Society o Alberta, Canada, says that voice tec nology allows companies to "contr the internal factors which impact on i come. One of the single greatest costs today's firms is that of support staff.

The average secretary spends 50% o more of her or his time performing document creation function. The (voic system replaces that function. Furthe more it does not have sick days, an does not ask for raises or superannu tion plans and is depreciable."

Dragon is also a top performer i database file creation and retrieval, an for accessing information from comple software packages such as spreadshee and accounting programs.

Julia Tyak, who runs a Brisbane med cal practice of some 500 patients week, says Dragon is now one of h clinic's "most important acquisitions" because each medical practitioner no speaks their own diagnostic or treatme files directly into the computer databas She says "This has increased the med cal terminology accuracy and reduce file entry time by one third of the trad tional (secretarial) input time, an reduced the cost of doing so by 1/6th"

Telecoms talk

Telecom companies worldwide see speech technologies as their natural medium, with a speech network infra- structure already in place. Some of the overseas applications speak a thousand words.

AOTC, British Telecom, Siemens, and the US 'baby Bells' are all testing low vocabulary and high-vocabulary products which can listen and respond to users at the office and home, from central databases, and from a plethora of business organisations offering new voice-interactive services.

Applications under test in laboratories and in the field include: 25-word carphone dialing systems; artificially- intelligent communicators for directory assistance, voice mail, and general information; voice-fax systems for fax creation and delivery by voice; and public interactive functions like requesting songs from automated radio and cable TV stations.

AT&T manager Joseph Olive says that the market for speech systems in America alone is worth "$1 billion with an annual expansion of 20%", and Dave Glowacz of Telephone Engineer and Management adds that telephone companies can each save $25 million a year by installing 'collect-call' automatic operators which allow a customer to say "collect call to Mr X, phone number —, from Mr Y" (10 words) and having X respond with a "yes" or "no" to the billing request.

History was also made last year on January 28, 1993 by Toshiyuki Takezawe of the Japanese Advanced Telecommunications Research Institute International (ATR) of Kyoto's Science city, who spoke for 20 seconds in Japanese and had his speech recognised, translated, and synthesised into an American accent for a Carnegie Mellon University scientist in Pittsburg. The translation system has a small vocabulary — 700 words — but the key message from Asia is talk technologies.

Initially skeptical, she adds that now "everyone is incredulous".

Medical terminology accuracy has increased at the practice because Dragon rarely makes a mistake when it deals with poly-syllabic words and because of the unusual phonemes of jargon.

Auscript's Horwitz has adapted Dictate to Lotus 1-2-3, dBase and others. He says "this sort of technology was just a dream in the 1970's; now it's a reality".

Voice 'macros'

Voice macros are part of the new power of the technology, allowing even the most reticent of boardroom directors and occasional users of software packages to overstep the keyboard barrier.

Macros are trained commands whereby a long string of words or phrases can be shortened to a special phoneme like 'Quebee' (for 'Queen's Council of Sydney'), allowing one utterance to replace up to 1000 keystrokes (approximately 100 words) — enough to make even the fastest typist shudder.

In accounting situations, one could develop macros such as "find me Peter Jackson's file", "give me Fred's balance", or "give me Peko's profit and loss for ninety-one and ninety-two". Dragon is ideally suited for such business tasks, with internal space for some 5000 macro commands.

Janet Baker, President of Dragon Systems, believes that such data entry retrieval applications represent "probably the single largest potential market (for the technology)".

Overall, Reynolds and Dragon's overseas promoters say that the thing that will attract small and large business users will be the time and cost savings.

Canada's Darcy Readman makes the point that by overcoming the major psychological and manual barriers for most professionals who have previously been allergic to computers, the technology can "shift the power balance to small or medium sized firms, who can now compete with the larger firms on a more cost effective basis".

Reynolds agrees, reflecting on an Australia with its unique population of hundreds of thousands of small businesses who must compete with Asia. He says "it not only replaces repetitious and routine tasks and can reduce staff ratios such as in the legal world from 2:1 to 1:1 — and CEO's and managers should see at least a 40% speed and efficiency improvement — but, I believe, it is the sort of technology that can really get companies moving".

There are also spatial as well as temporal effects of the new technology. SR proponents say that SR technology occupies less space than equivalent staff, therefore it lowers office rentals. And with the new digital and fibre communications systems transferring voice over distance, it "may release us to exercise skills and expertise in a more comfortable environment — the home", says one enthusiast.

About Dragon Systems

SR industry pioneer Dragon Systems was founded in 1982 by Jim and Janet Baker, both formerly researchers at IBM. Janet Baker, currently the firm's President, is a biophysicist and neurophysiologist with a strong interest in information processing and biological systems; Jim Baker is a mathematician and specialist in stochastic processing, Hidden Markov Models and statistics.

Dragon is based in Newton, Massachusetts, but also has an R&D facility in Cheltenham, England. It has rapidly established itself as the leading supplier of PC-based speech recognition software, and its 'speech recognition engine' is incorporated in Microsoft's 'Windows Sound System' PC audio card.

Late in 1993, Dragon Systems and US specialist semiconductor maker Analog Devices were jointly awarded a US$3 million grant by the US Government, to develop speech recognition systems with scalable software to fit available memory and a variety of DSP hardware to run on various platforms — from desktop PCs to handheld PDAs (personal digital assistants).

In other words it will allow voice-commuting. Pam Nott of HSM Consultants Pty Ltd, a business advisory group, hones in on the big thrusts of recent years in award restructuring in multi-skilling terms — saying that she is now having to "train executives to do their own typing — that's a fairly costly process, and Dragon is an excellent solution".

It's a wonderful breakthrough for them, putting them back in control of the way they work, out of hours, in hours."

She adds that it is excellent for professionals who have to travel, and people who do field interviews, because it can work on the compact 486 portable computers, and for RSI sufferers. "By doing that work on site, saving it on disc and perhaps also to print, you are finishing that process and you can move on, physically and in your mind."

There are also the important issues of retraining personnel, and the challenge soon likely to face Australian business: EEO for disabled workers. Disabled workforce laws have already come into

Industry talk

In 1992, car assembler Rover Group Ltd installed an SR system at its Cowley plant in Oxford, UK, allowing a finishing inspector's hands and eyes to be free to perform quality checks both inside and outside the vehicle, without writing anything down.

St Joseph's Hospital in Tucson, Arizona is using a Dragon-based voice system in its cytology and pathology laboratories. The voice system keeps a cytologist's eyes focused on the pap-smear slides, to improve diagnosing accuracy, while at the same time saving an estimated 40 minutes per hospital shift, by eliminating paper recording.

The US Postal Service in Oklahoma City is likewise verbally sorting its mail bags at 'four times the old (non-verbal) rate'. The US Army has tested a 100-word system to assist helicopter pilots.

Janet Baker of Dragon says that "Lenox China uses the system in its manufacturing process to do inspection, while Burlington Industries uses it for tactile inspections (similar to Rover)", as well as for "PC-board inspections, and in toxic materials handling".

For hands-busy workers, speech is a valuable, time and cost saving assistant.

But there are numerous other applications in a talkative world. Currently under test are voice commanded carphones, VCRs, house and kitchen systems and toys. There are also restaurant ordering systems (according to *Restaurant* magazine), voice ticketing machines at the rail and bus terminals, and even a smart, 'counter-argument' electronic car salesman under test in Germany.

Some white collar applications of SR are just as powerful as document creation. Baker says that "Xerox Corporation is now using our equipment in counting inventory by voice, with a tremendous return on savings. They went from being able to do 15% of a sample audit in six months to being able to do a 100% audit in two months, covering 2.2 million parts in 15,000 locations."

She adds that US firm McCormack and Dodge are using Dragon to help demonstrate their new financial software packages to clients, at many locations throughout the world. By being able to control both the packages and the data entry itself by voice, "it allows the salespeople to concentrate on the job they do best — sales".

Periphonics Corporation of New York has begun to install speech technology in some New York banks, to free personnel from repetitive customer inquiries such as account balances. Amway Corporation now uses such a recognition system for its thousands of dealers to place merchandise orders around the clock.

Shop-floor talk, shop talk, business talk, table talk, small talk — the message is talk technologies. Whether they are in stand-alone applications or networked, the technologists are destined to harness this most powerful of the senses across a wide user spectrum.

effect in the USA in mid-1992, guaranteeing EEO in American businesses. Similar laws are set for Australia, and speech systems provide solutions.

"A key selling point for people who have had zero contact with computers, but are now having to re-enter the workforce or retrain, is that speech is a powerful tool to allow them to participate in and come to grips with the new work technologies", says Reynolds.

Enormous potential

But only the tip of the iceberg is visible so far in the speech user spectrum. In America, a pathology laboratory is using Dragon to provide more accurate 'hands free' recording of pap-smear slide information; postal employees are sorting mail bags by voice; and Rover cars now have their finishing inspectors wired for sound to allow for hands-free verbal detailing.

The telecommunications giants see voice as their natural communication technology, and have a phone system already in place to use it to its full capacity.

There are voice-commanded phones, 'verbal faxes' (delivered by voice) for those without fax machines, and numerous information database service applications under test which can respond to any phoned-in inquiry. There is even a 700-word vocabulary Japanese to English real-time translation system under test.

These 'public' speech recognition technologies, often called 'natural language processing' technologies, must deal with accents, poor speech, low volume speech from the elderly, popular speech patterns, swearing and slang, and thus require a new wave of breakthoughs for their global realisation.

According to Reynolds, a desktop version is under test now in the Dragon labs at Boston, running on a processor with 80MB of memory. It might appear that Dragon has already solved many of the complex mathematical and statistical processing barriers, which some critics said would take a decade to be resolved.

In November 1989, Dragon's Janet Baker had said that this Holy Grail was "at least three years away". In 1992, she unveiled their first 'Model-T' system — a large vocabulary 2000 word machine, which has double the capabilities of the research giant AT&T's continuous speech system under test.

But as Pam Nott says, the fast, continuous-speech machines might require a 686 computer to make them fly, considering that machines with the 586 (Pentium) chip are only just reaching the market. Reynolds adds that "sometimes that last 1% can in fact be a major hurdle, and the natural speech machines might be several years down the track".

Talking future

Money used to talk — now talk is big money, and Baker says that those companies that delay in entering the speech field will end up "three years behind their competitors".

One thing is certain — our work, our roles, and our computing and communications are never going to be the same again. If speech-tech is equivalent to the invention of the wheel, as one enthusiast reported recently, or metaphorically equivalent to the 1950's invention of the transistor, then the horizontal spread of the technology will give voice to many original ideas as well as millions of people.

That comment by Bill Gates of Microsoft is worth quoting again, as a summary:

"If you want to know where to put your millions and millions of system dollars, you should use your own body as a guide — speech, listening, handwriting, touch — it's totally predictable that these are the key technologies (of the future)." ❖

How speech recognition works

For the technically-minded, the mathematics behind recognition systems is a remarkable advance — and also a closely guarded trade secret. The secret is in the design of the voice to data conversion algorithms and the speed with which they can act to match sounds. It is also in the multi-disciplinary approach to the speech problem.

Professor Mary O'Kane of the University of Canberra's speech research effort says that the recognition of speech through background noise with instant response is a "truly heroic endeavour". She says that the fashionable classical or mainstream approach to the problem is through so-called Hidden Markov Models (HMMs), developed by American scientists — especially those at Carnegie-Mellon University. HMMs are training algorithms requiring hundreds of speaker examples for every trained word. This approach is expensive and requires massive amounts of processing power and large databases. The Bakers used HMMs in their early research.

However, the Bakers and O'Kane now prefer a statistical rule-based approach, which attempts to find the basic keys which are the templates for the building blocks of words. Essentially the goal is to find the skeletal rules in phonetics, phonology, syntax, and semantics, which combine to build syllables, words and phrases. "Larger linguistic units are derived from sequences of these basic patterns", she says.

Journalist J P Donlan says that "Dragon avoids the traditional artificial intelligence techniques in favour of rudimentary statistics, to determine probability of sequences of words given the context and acoustic inputs".

An example is the two sentences "how to wreck a nice beach" and "how to recognise speech". The word 'wreck' closely matches the first syllable in 'recognise' and when patterns are this close, with the computer hunting amongst its sound and word pool for a match, the correct choice usually depends on the context of the sentence. The statistical models guess how likely it is that a person will say 'recognise' as opposed to 'wreck a nice'.

Another example is "I want to check in", as opposed to "I want two chicken". According to the researchers, the speech algorithms can be fine-tuned to make these distinctions, depending on whether companies want the SR for an automated hotel reservation system or an automated food ordering system.

An added bonus of developing these algorithmic and statistical rule systems is that they can often predict the next likely phoneme or word, so as to be one step ahead of the speaker for fully continuous speech applications. The rules also allow inference to supply the correct sound or word in a sentence context, if a door slams and over-rides the speech.

Auscript's engineer David Horwitz had observed from his own tests that Dragon Dictate-30K was acting as 'an inferential engine', but no documentation from Dragon ever admitted to this function — for commercial reasons, he believes. He says that Dragon's algorithmic models — or 'templates', as they are called — "are very good".

What about future breakthroughs and paradigm shifts? The Uni of Canberra's Mary O'Kane says that a multi-disciplinary approach to the field "is absolutely necessary, because you need to draw on inspiration from linguistics and psychology, in addition to computer science and electrical engineering in order to progress in this field. The mainstream AI people don't often appreciate the fact that we have a great need to know about other disciplines."

Dragon Systems founders Jim and Janet Baker are a telling story. Janet Baker is a biophysicist and neurophysiologist, with a strong interest in information processing in biological systems, while Jim Baker is the mathematician and specialist in stochastic processing, HMMs, and statistics. Their collective effort in producing Dragon and its achievements is testimony to the power of a multi-disciplinary approach.

The next scientific challenge is the holy grail of speaker independent, continuous-speech machines. When that algorithmic and statistical barrier is solved, scientists will have truly reached an historical plateau, from which to launch numerous paradigm shifts of global significance.

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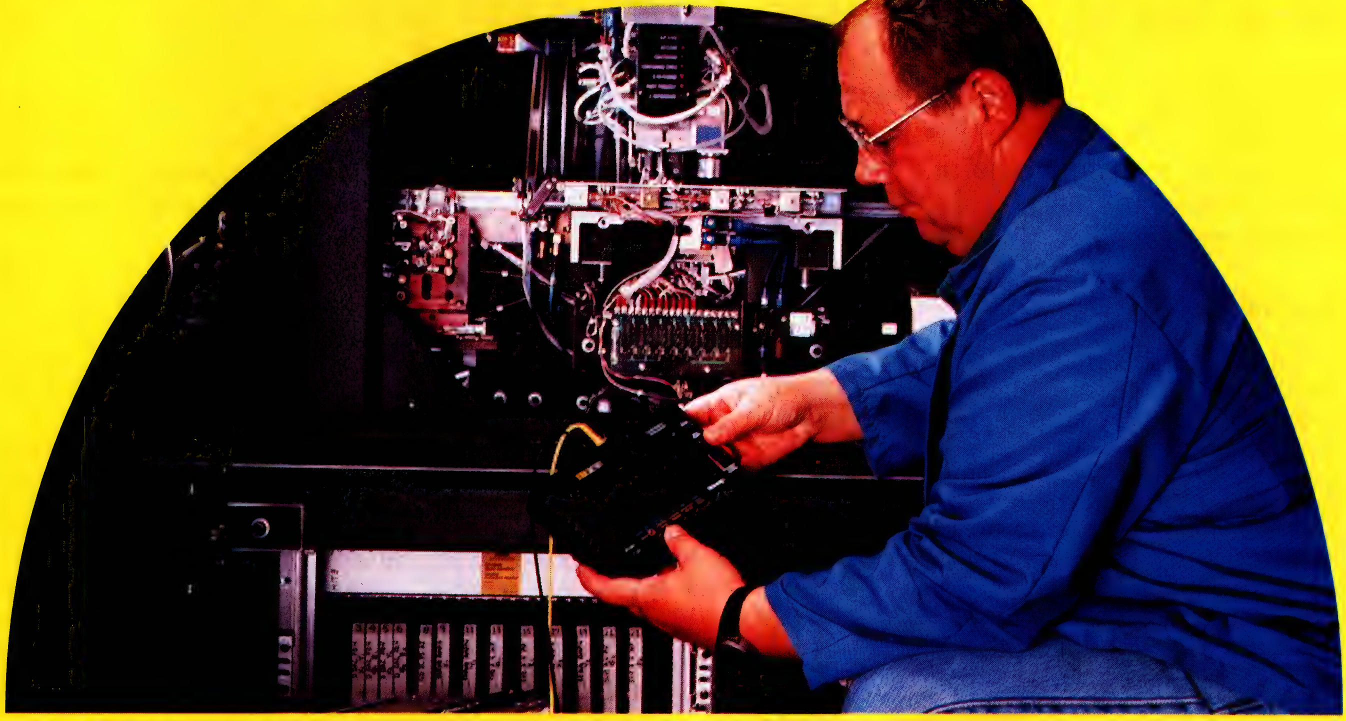

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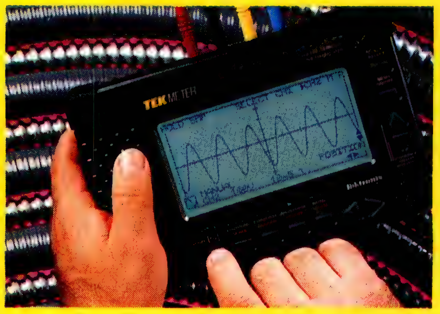

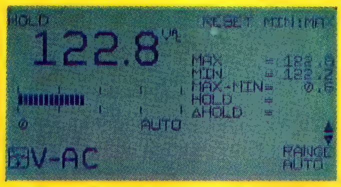

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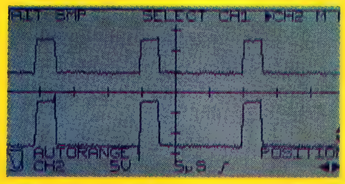
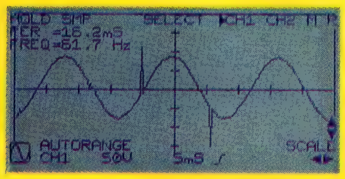


Dual channel operation allows relative timing of signals to be observed.



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The National Film and Sound Archive:

Preserving Australia's audio-visual heritage

Ten years ago this month, the Hawke Government set up the National Film and Sound Archive a an agency separate from the National Library, to develop and preserve a collection of Australia' heritage of moving image and recorded sounds, plus their associated documentation and equipment. A few weeks ago, *EA*'s Editor Jim Rowe was invited to tour the Archive, to see what has bee achieved in those 10 years...

by JIM ROWE

Long-time readers of *EA* may perhaps recall that 15 years ago, I wrote a story about the work being done by the National Film Archive, in Canberra. At the time, the Archive was part of the Film Section of the National Library, with a staff of only 15 people. A couple of years previously, I'd also done a story on the Library's Music and Sound Recording Section, with a much smaller staff again.

In each case I had been able to visit the departments concerned, and see for myself the work they were doing to preserve our moving image and sound recording heritage. And both times I was most impressed with the enthusiasm and dedication of the people involved, and what had been achieved — despite the fact that they were very limited in terms of staffing and other resources, and were accumulating a huge backlog of work as a result.

It struck me at the time that both sections were labouring under a kind of 'Cinderella syndrome' — they seemed to be almost token appendages to the main body of the National Library, understaffed and underfunded, and existing largely to disprove any possible criticism that the Library's top management had ignored the development and use of audio-visual media in recording our cultural heritage. There wasn't much evidence of any real convictio that the job being done by either sectio was an important one.

Kathy Bromley reassembling the pieces from an old lacquer disc recording, in the NFSA's sound preservation section. After recementing them to the disc, the recording is played back and re-recorded after digital filtering.

Since then, of course, things hav changed. After a fair amount of lobbying by the film, sound and cultura bodies, and also concerned individuals in April 1984 the Hawke Governmen effectively split both sections away fron the National Library, and combine them to create a separate and semi autonomous agency known as the National Film and Sound Archive (NFSA).

In October of the same year, the nev Archive moved into the old Institute o Anatomy building, and at the officia opening Prime Minister Bob Hawk made it clear that the work the nev agency was to perform had at last bee recognised as important:

"The Archive will ensure the development of the necessary skills, facilities ethos and methods needed fo Australia to preserve our heritage o films, radio and television programs sound recordings and associated items that are in their own right of lasting cultural value. Its establishment is a cultural landmark for Australia. It has alsc made clear the Government's intentio to see this work given the status an resources it needs..."

An Advisory Committee was also se up, chaired initially by film produce Joan Long, and within 18 months thi had prepared a statement of the NFSA' principles, philosophies and policies. S the Archive had finally been establishe on a solid footing, and there seemed t be real committment to giving it th resources needed.

As someone with a long-standing personal interest in both the content an

Since 1984, the Archive's head office has been in this lovely old (for Canberra) building in McCoy Circuit, Canberra. The building formerly housed the Institute of Anatomy. The basement of the building, which was once used to store preserved anatomical specimens (including the heart of famous race horse Phar Lap), is now used for the NFSA's laboratories.

echnology of films, sound recording nd television, I had noted these events with interest. But as time went by, I wondered how things were going with he Archive — had everything worked out as planned, once it gained semi-autonomous status, and better funding?

My opportunity to find out came a few weeks ago, with the arrival of an nvitation to pay another visit. The invitation came from Ray Edmondson, the Archive's current Deputy Director — who was the head of the Film Archive back in early 1979, and had shown me round then. Ray felt sure I'd notice quite a change in the interim, as well as being able to judge what progress had been made in the last 10 years since the NFSA had finally 'come of age'. He wasn't wrong.

Dramatic change

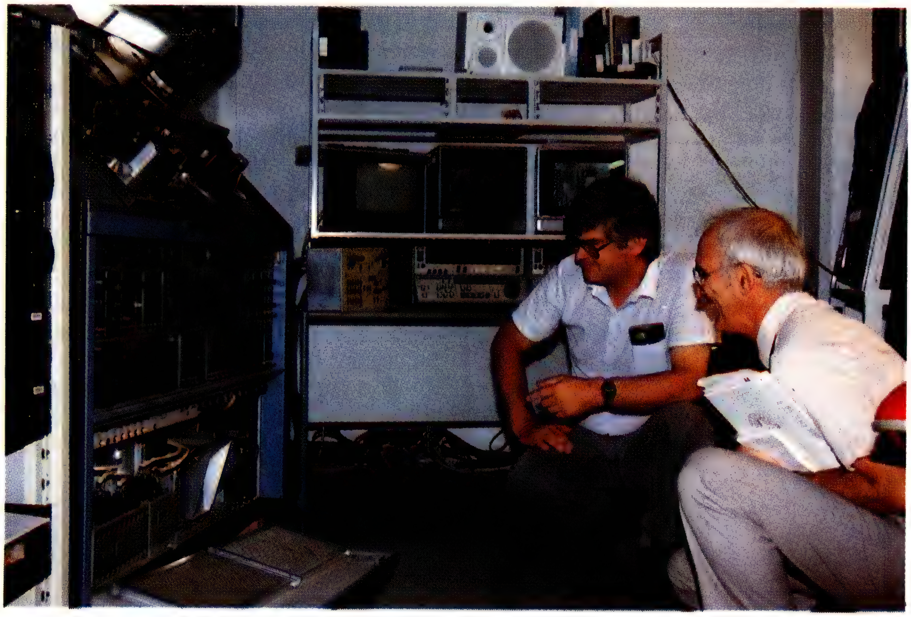
There's almost no resemblance between today's NFSA and those Cinderella sections of the NLA, back n 1979.

Fifteen years ago, the Film Archive and Music/Sound Recording sections of the NLA had fewer than 20 staff between them; the NFSA now has around 130. In 1979 they were squeezed into a couple of spare areas in the NLA building; now they occupy not only the fine old (for Canberra) Institute of Anatomy building, but some smaller adjoining buildings as well — with branch offices n both Sydney and Melbourne.

Back then, all of the Film Archive's collection of early 35mm film on inflammable cellulose nitrate stock had to be stored in relatively poor conditions, in a munitions warehouse in St Marys, Sydney. Now, it resides in a purpose-built complex of fireproof vaults in the nearby Canberra suburb of Mitchell — under environmental conditions that are tightly controlled to ensure optimum preservation.

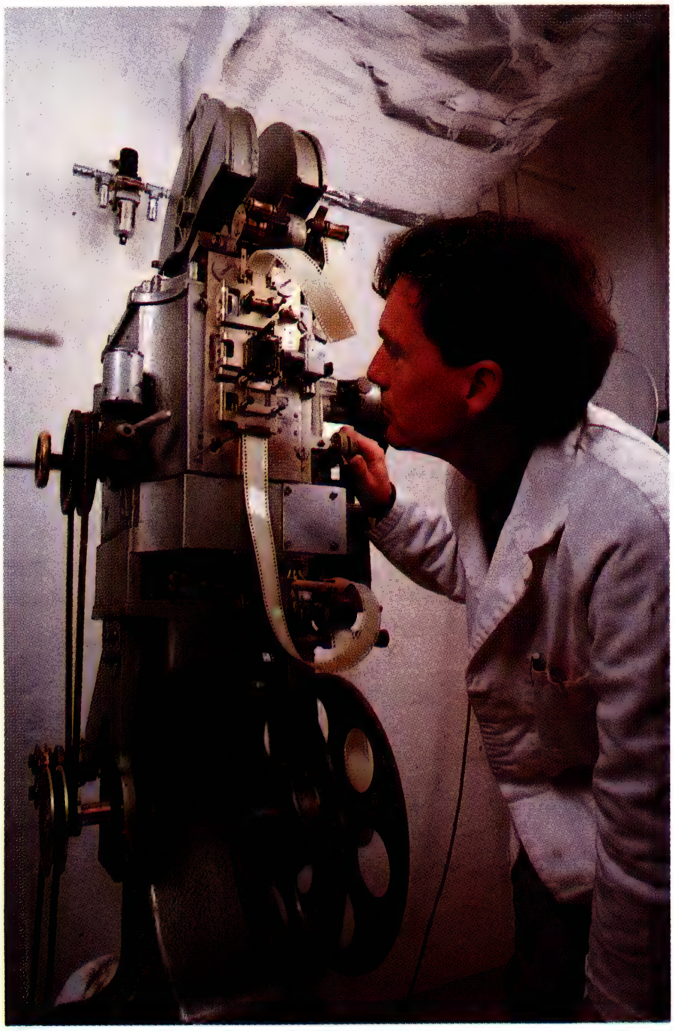
A major task of any film archive is to copy films on old and deteriorating film stock over onto new stock, to ensure the preservation of its content. Back in 1979, all of the copying and film processing had to be sent to commercial laboratories in Melbourne and Sydney; if I recall correctly, they were the only firms still equipped for processing black and white film. Nowadays the NFSA does all its own copying and processing, and maintains a fully equipped B&W printing and processing lab.

In 1979, the Music and Sound Recording section seemed to be little more than a storage area for cylinder and disc records, radio programme transcriptions, magnetic tapes and sheet music; I didn't see any facilities for either restoring damaged or noisy recordings, or making copies — for preservation or access. Now, however, the sound preservation section of the



Video Preservation manager Erik Liepins showing Jim Rowe the electronics inside the NFSA's RCA model TR-70 video tape recorder, used to record and replay 2" quad tapes. Beautifully engineered, it draws a massive 2kW.

Australia's audio-visual heritage



A film preservation staff member examines one of the NFSA's step contact printers, used to make copies of old and decaying films.

NFSA staff members Marcello Sommariva, Melita Dahl an Sally Jackson shown working in the film vaults at th Archive's Mitchell Repository.

NFSA has quite impressive lab and studio facilities for both restoring and copying old recordings, not only for preservation but also for access.

Again, I don't recall seeing any video tapes or equipment during my first visit, although there may have been a few tapes. Now, however, a full section of the NFSA is devoted to preservation of the video medium, with an impressive array of videotape machines covering virtually every format from the original 2" quad system pioneered by Ampex, right down to the latest digital machines. The video laboratory also boasts a Rank-Cintel flying spot telecine machine, for transferring images and sound from film to video. (Apart from anything else, this is used to make video copies of old films, to send to students and researchers who are not able to go to Canberra.)

The NFSA is now marketing copies of some of the more popular items from its collection, on video cassettes, audio cassettes and compact discs. It also sells things like copies of old posters, and postcards with images of movie memorabilia.

In the main building it has an exhibition area, its own reference library and viewing/listening rooms, where researchers can have private access to the Archive's priceless resource material...

In short, then, today's NFSA is virtually a quantum leap away from those modest archive facilities I saw 15 years ago. About the only thing that *hasn't* changed is the dedication and committment of the people who work there; that's still very much in evidence, I'm happy to report.

On the tour

There were so many interesting things to see during my tour of the Archive's facilities, that it's hard to know where to begin in giving you a brief rundown.

I was most impressed with th sound preservation section, for example, where I was given demonstration of the Sonic Solution 'No-Noise' digital de-click, de-crackl and noise reduction system, used t make dramatically clearer copies of ol and damaged recordings.

The section's Matthew Davies firs played an original recording made whe pioneer aviatrix Jean Batten landed i Sydney after the first solo flight fron London to Australia by a woman, in October, 1936 — a barely audible inter view, because of a heavy overlay c surface noise, crackle and clicks.

Then he played the same thing afte cleaning up via the No-Noise system and suddenly you could hear quit clearly not just what was being said, bu also Batten's engine purring gently i the background!

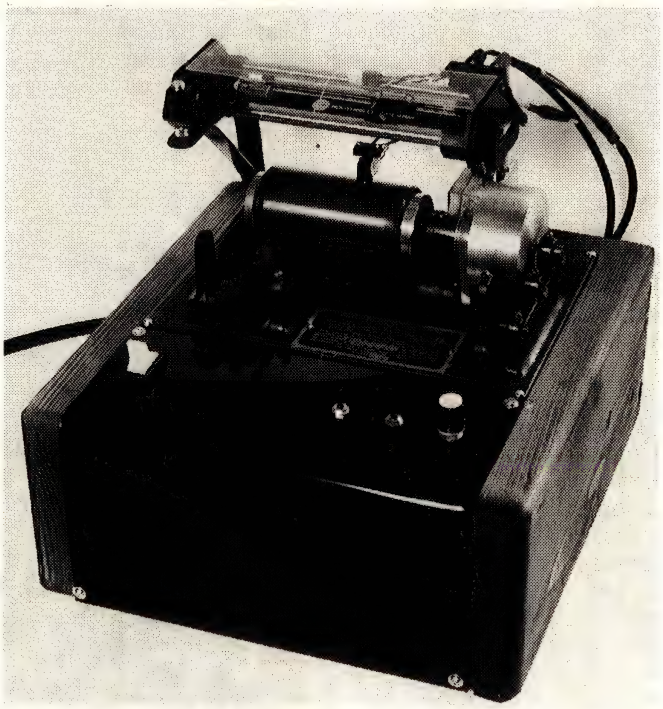
In an adjoining studio I met dis recording transfer specialist Ben Whit

In the Archive's sound preservation section, a Sonic Solutions 'No Noise' digital filtering system is used to remove background noise, clicks and crackles from early recordings. It consists of a set of specialised hardware, plus software which runs on a Macintosh computer.

ten, who was deciding on the best stylus and tonal equalisation curve to use, when copying an early radio programme recorded on a 16" lacquer disc. Ben has at his disposal an impressive array of stylii, in a range of different shapes and radii, to allow optimum playback from almost any kind of disc recording; he also has a very flexible system of sub-band and parametric filters for equalising.

Matthew Davies also showed me examples of old lacquer disc recordings where the lacquer layer containing the actual recording had 'crazed', and many of the segments had peeled off. By painstakingly matching the pieces in jigsaw-puzzle fashion and gluing them back into place, NFSA staff had been able to restore the recording — well enough so that after passing through the No-Noise system to remove the clicks, it sounded surprisingly good.

I was also very interested to see an electronic player for the old Edison cylinder recordings, made in the early 1980's by the sound section's current manager Ian Gilmour. Based on the mechanism from an Edison 'Standard Phonograph Model D', it now sports variable-speed electric drive, a Southern Linear arm and a high quality Stanton stereo cartridge — with its outputs connected to produce a mono output from the 'hill and dale' recording system used on the cylinders.



The electronic player for early cylinder recordings is based on an old Edison phonograph, modified with electric drive, a linear tracking arm and a Stanton stereo cartridge.

Needless to say, another area of considerable interest to an old movie buff like myself was the film printing and processing lab. Here lab manager Les Cassidy showed me around, and I was able to see the contact printers used for same-gauge copying, and the optical printer used for copying from one gauge to another. It was interesting to learn that the lab needs to have a range of different sprocket sets on the contact printers, with graduated teeth pitch, to allow them to copy old film that has shrunk in size.

The continuous B&W film processor was also impressive, in its glass-enclosed and separately air conditioned room.

Computer system

Understandably, keeping track of a huge collection of items like that held by the

Preserving Australia's audio-visual heritage

Video Preservation manager Erik Liepins operating his department's RCA TR-70 video tape recorder, one of their two machines capable of recording and playing in the 2" quad format. The other machine is an Ampex AVR-2.

NFSA involves the management of an enormous amount of information. Quite apart from the need to catalog every film, radio programme, sound and video recording, and other items like posters, programme notes, scripts, etc., there's also the need to record information on their physical condition, preservation status, original source and so on.

To allow it to manage this enormous information database, the NFSA has developed its own computerised management system called AIMS (Archive Information Management System), in collaboration with Canberra-based software firm Wizard Information Services. AIMS is based on the 'Oracle' DBMS package, and runs under the Unix operating system. It's currently running on a Sequent Symmetry 2000/450 computer, and the size of the database is at present around one gigabyte.

Just about everyone in the NFSA seems to need to access the AIMS database, because it has allowed virtually full integration of the various Archive activities. Information Technology Manager David Watson gave me a demo of its capabilities, and it's most impressive. You can find out just about everything you'd want to know, on any item in the collections — even such things as the loan status of VHS tape copies, and any alternative spellings for the names of the people involved in its creation.

In fact AIMS has turned out to be so good, in terms of its ability to facilitate Archive operation, that the national archives of other countries have shown interest in acquiring it to improve their own information management. It may well turn out to be quite a nice money earner for the NFSA, and a significant contributor to Australian software exports...

The video section

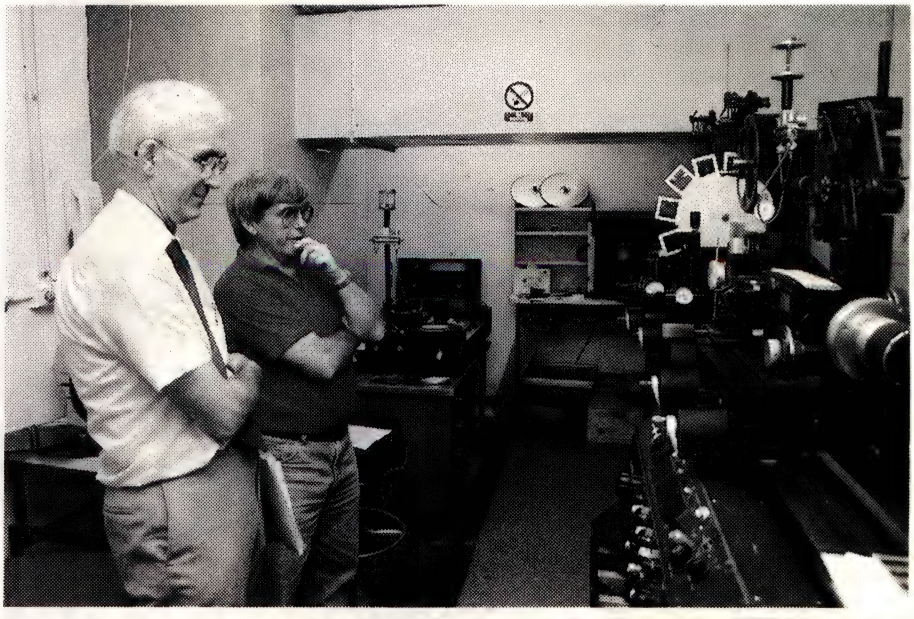
All in all, though, I have to confess that from a technical point of view I actually found the video preservation section of the NFSA the most interesting of all. Which is quite an admission, really, for someone who has always been more interested in film technology than in TV and video!

Perhaps it was because when I visited the Archive the first time, there wasn't a video section as such; so it was all 'new'. Or perhaps it might be because I really can't help being interested in electronic equipment — whether it's old or new!

One thing I *do* know is that while the NFSA's Video Preservation Section Manager Erik Liepins was demonstrating the various video recorders they use to play and transfer their programme material, it suddenly struck me that it had all been developed, brought into use — and in some cases, dumped into obsolescence — since I joined the workforce back in 1957. A somewhat sobering thought...

Erik Liepins and his staff are very proud of their two functional 2" quad video machines, for example — one an Ampex AVR-2 and the other an RCA TR-70. They're now almost a part of history themselves, as two of only a few working 2" videotape recorders left in Australia; yet I remember when the first 2" Ampex machine was brought into Australia in 1957 by Murray Stevenson, Chief Engineer of Sydney's Channel 7 — the very first VTR seen in the country!

Mr Liepins told me that although both Ampex and RCA now regard the 2" quad machines as obsolete, and don't



Film Laboratory manager Les Cassidy showed Jim Rowe the NFSA's optical printer, used to copy film material from one gauge to another.

really support them, the NFSA has been able to acquire a number of other old 2" machines which they can 'cannibalise' to keep the AVR-2 and TR-70 going for quite a few years yet. And this illustrates rather clearly one of the facts of life, for an archive like the NFSA: in order to be able to play back either images or sounds on obsolete recording formats, they need to keep and maintain machines capable of playing all of those formats.

So it's not just a matter of restoring and preserving the collection of recordings — an archive has to become a kind of 'working museum' of equipment, whether it wants to or not...

Another item I found very interesting in the archive's Video Preservation section was the Rank-Cintel flying-spot telecine machine, used to transfer material on either 35mm or 16mm film over onto videotape. This type of telecine is ideal for the job, as it is very gentle on old and fragile film, and is also remarkably tolerant of damage such as missing sprocket holes.

Erik Liepins told me that they'd like to be able to use it for transfer of material on other film gauges, like 9.5mm and Super-8. However this would involve modifying additional gate assemblies, and these cost over $30,000 each when new. The NFSA's budget won't allow this at present, so they're on the lookout for any secondhand or 'shopsoiled' gates which may come to light.

Achievements

So after 10 years of operation as a separate entity, the National Film and Sound Archive is now a flourishing enterprise, much larger and with significantly better resources than was evident back in 1979.

And as you'd hope, this has enabled them to achieve rather more, not just in terms of the basic restoration, preservation and management of items in the collections, but also in both providing access to them and actively bringing some of their treasures out into public view.

For example in 1988, with sponsorship from News Corporation and the Greater Union Group, the NFSA launched a $4 million project called 'Operation Newsreel', to repair, preserve and catalog the nation's 4000-odd newsreels. (It's still running.)

Typical examples of these, along with compilations dealing with various themes, are now available on VHS cassettes. As part of this project the NFSA collaborated with the Australian Film, Television and Radio School in the production of 'Australia's Last Newsreel'.

By combining copies of the Archive's incomplete Australian and American release versions of the 1927 Australian silent classic *For the Term of His Natural Life*, film historian Graham Shirley was able to reconstruct a virtually complete version of the film. This was made in a form suitable for screening in a modern cinema, with an authentic musical accompaniment prepared by John Godfrey and Bransby Byrne, and recorded by the Palm Court Orchestra. This has been very popular, and is now also available on VHS cassette.

Other films that have been made available in VHS form include Raymond Longford's *The Sentimental Bloke* (1919), Tal Ordell's *The Kid Stakes* (1927) and *His Royal Highness*, the first film made by George Wallace in 1932.

On the sound recording side, the NFSA has prepared compilation recordings such as *Popular Tunes of the 1920's*, *Melba*, *Popular Australian Singers* and *Australia's Billy Williams*. These are available at very reasonable prices on compact cassette, with some also available on CD.

Of course the NFSA also provides historic footage and sound recordings on an almost continuous basis to TV, radio and film producers, along with providing access to researchers.

So all in all, the archive has come a long way since I wrote those stories about it back in the late 1970's. It now really is able to perform the important job of preserving Australia's heritage of moving images and sound recordings — something for which our future generations will no doubt be very grateful.

By the way, if you have any historic Australian films, sound recordings or video recordings which you know should really be preserved for posterity, why not write to the NFSA and let them know what you have? Their address is National Film and Sound Archive, McCoy Circuit, Acton (PO Box 2002, Canberra) ACT.

Finally, my thanks to Ray Edmondson and his enthusiastic team at the NFSA, for their courtesy in showing me around the Archive. I'm also grateful to Elizabeth Frost, Matthew Davies and Erik Liepins for their additional help in preparing this article.

All of the photographs shown in this article were supplied by courtesy of the NFSA. Most were taken by photographer Arthur Mostead. ❖

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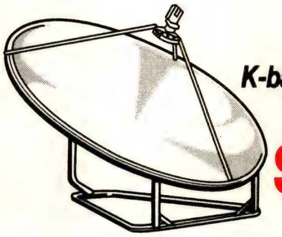

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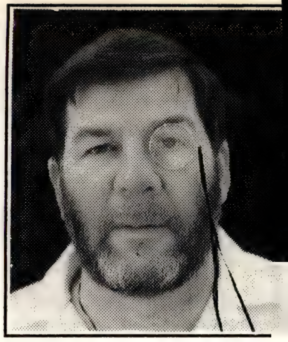
Moffat's Madhouse...

by TOM MOFFAT



A high-tech fairy story

Once upon a time there was a man who owned a thing called a computer, which was a rather remarkable instrument. The man used his computer as an electric typewriter, upon which he tapped the keys night and day to write stories — so that the people of the land might be entertained and enlightened.

To do this the man used a software package called WordScribble. He was very happy with WordScribble, and he rejoiced, saying, "I am going to use WordScribble forever and ever". And this he proceeded to do.

Back in ancient times, around 1985, the man used WordScribble on a computer known as the 'CP/M' kind. He was immensely happy until his old CP/M machine broke down, after which he was forced to replace it. But they had stopped making CP/M computers by then, so he had to get a newer model, a 'PC with MS-DOS'.

The CP/M version of WordScribble would not work on the man's new MS-DOS machine, so he had to buy a new program as well: WordScribble for MS-DOS.

With great feelings of terror, the man placed the new WordScribble into his MS-DOS machine and turned it on. "I won't know how to use it", he cried.

But the man was needlessly concerned. The new WordScribble worked exactly like his old CP/M version in every way; the same screen appearance, the same keyboard commands, everything. Mind you, the new one wasn't quite as fast as the old one — but that's progress for you.

The man resumed using WordScribble forever and ever, and all was write with the world. New computers came along, with newer versions of MS-DOS, and their makers told the man he needed one. "What for?", he said. "There's nothing wrong with my old one." And, boys and girls, there wasn't anything wrong with the man's old computer. Nothing at all.

The man continued using his old computer, and WordScribble, forever and ever. And the software makers gnashed their teeth. And the computer makers spat chips. They just couldn't make the man buy a new computer, or even new software.

Actually the man *was* forced to buy a new computer from time to time, but not through the efforts of the computer makers. His old computers simply wore out after so much daily typing, and that was fair enough. But the man steadfastly refused to replace his much-loved WordScribble program, since it didn't wear out. It was only software, after all.

While the man was busy typing stories every day, computer and software makers were 'addressing the problem', as they say in computer new-speak, of how to make the man part with his money when in fact his computer and his WordScribble program were both working perfectly. "Let's try to make him dissatisfied with it!", they said, and a plan was hatched.

At around this time a new kind of computer came along, probably named after Mr McGregor who got Peter Rabbit into so much trouble. This new machine became known as a Mac. It didn't use text and words so much on the screen; instead there were little symbols. And there was this scooty thing you could push around on the desk to select one of the symbols on the screen. It was called a 'mouse' and it was really cute, and everyone would want one.

Mr McGregor blew his trumpet and yelled, "Keyboards are dead! Long live the mouse!" And many people agreed with him, and threw out their old computers and bought new ones with little symbols on the screen, and mice. These computers were said to be 'user friendly'.

The makers of PC-type computers were very distressed to see that Mr McGregor had finally found a way to make people throw away their old computers, because the new ones they were buying were *his* Macs, not PC's. So PC makers put their noses to the grindstone and came up with a way to make their PC's look just like Macs, complete with mice. How nice! This new system was called 'Curtains'.

Advertisements thundered from the pages of computer magazines: "DOS is dead! Long live Curtains!" Articles pointed out that computers could no longer do useful work unless they were using the new Curtains. They also made it perfectly clear that people who remained happy with their old DOS computers and programs were living in the past.

Still, many resisted moving to Curtains, because their older systems were working so well. The man in this story even had the temerity to question in this very column, the wisdom of the great stampede to Curtains. That story brought heaps of scorn from those who had been converted, and praise from people who were sick of being told they were silly because they resisted switching to Curtains.

Switching to Curtains, of course, mean that you had to get new software which was especially written for the Curtains environment. WordScribble for Curtains quickly hit the market, and many perfectly good copies of WordScribble for DOS hit the scrapheap. Mr Scribble was ecstatic! People were buying his programs again, even though there was nothing at all wrong with the ones they already had.

The Curtains system had some interesting characteristics, as well as its icons on the screen and its mouse. It would let you do two things at once, for one thing. You could write seditious magazine articles, while at the same time using a drawing package to make impertinent pictures to go with them. The results could then be merged into one stunning creation.

These activities, of course, required enormous amounts of memory and a lot of effort on the part of the computer. So the older computers were no longer up to it, and the person who had switched to WordScribble for Curtains now found he was up for a new 'computer for Curtains'. Mr Computer-maker was ecstatic! People were buying his computers again, even though there was nothing at all wrong with the ones they already had.

The man continued to write his stories,

with his much-loved WordScribble, on his faithful MS-DOS computer. As computers wore out he replaced them, eventually discovering the joys of sitting on the beach, writing his stories on a portable laptop computer, with WordScribble. But even that computer eventually died, so the man who was by then incurably hooked on portables, got the latest you-beauty notebook computer. With Curtains.

With CURTAINS? What did he say, boys and girls — WITH CURTAINS?

Well, er, yes. The man didn't have any choice by then, you see. Because you couldn't buy any computer without Curtains. Just to make sure users didn't deviate from the correct course, all new computers in the land were supplied with Curtains. In most cases computers were arranged so that Curtains appeared on the screen immediately the power was switched on. The owner was given no choice of using MS-DOS.

The man really tried to resist. "Won't you let me buy a computer without Curtains?"

"No. We don't do that."

"Well, how about un-installing it, so the computer at least starts life as an MS-DOS machine?" This was done, by the simple expedient of disabling the part of the automatic-starting procedure which energized Curtains. Curtains itself was left intact. So the man installed an old copy of MS-DOS WordScribble on his brand new computer, and proceeded to use it forever and ever to write stories so that the people of the land might be entertained and enlightened. All was well again — for the time being.

From time to time, as the man was fiddling around within MS-DOS, he noticed this command called 'WIN'. He knew what the command would do if he used it, and he said, "Nooo, that's not for me..."

But then curiosity got the best of him and he said, "Lets WIN! There's nothing to LOSE!" So he invoked the magic word, and lo and behold the genie came out of the bottle and squirted little icons and symbols all over his screen.

The man grabbed the mouse and moved it, and clicked it, and observed things dragging and opening and closing, and he said, "Hey, this isn't so bad". He played around with some of the supplied programs and then he remembered that his friends had told him how good Curtains games were.

A call to the local computer bulletin board provided him with a few games to try, and they *were* very entertaining and enjoyable. Except for the occasional game that produced a message saying 'THIS COMPUTER HAS BECOME UNSTABLE. RESTART IT NOW!' So much for the game in progress. What if he had been using a word processor, and was two thousand words into a story...

Well, what about a word processor? The man didn't have a wordprocessor for Curtains, because they were not to be found on bulletin boards and were very expensive to buy. But he did note that Curtains allowed such things as 'DOS applications', which were your old programs used within the Curtains environment. What would happen if he ran WordScribble as a DOS application? Then he would be seen to be 'modern', using Curtains — while actually using his good ol' DOS-based WordScribble.

To cut a long story short, this attempt brought howls of rage from Curtains: 'STOP! THIS APPLICATION HAS VIOLATED SYSTEM INTEGRITY DUE TO AN INVALID GENERAL PROTECTION FAULT AND WILL BE TERMINATED.' (With extreme prejudice?) 'QUIT ALL APPLICATIONS, QUIT CURTAINS, AND THEN RESTART YOUR COMPUTER.' (If that's what Curtains calls user-friendly, I'd hate to see it when it's really angry...)

The man eventually discovered he had a Curtains wordprocessor after all, a thing called 'Write' that came as part of the Curtains package. This little gem could produce words on the screen in all sorts of interesting type faces and sizes, and print them out on the printer exactly as they looked on the screen. He thought Write would be useful to enhance a for-sale poster he was making for a boat.

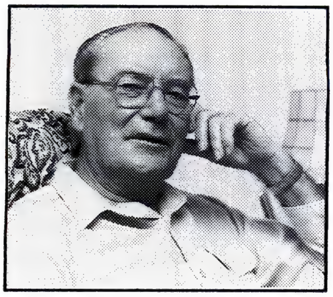
The man typed a couple of paragraphs of text extolling the virtues of said boat, and then printed them on a piece of paper below the boat's photograph. It all looked very nice indeed, and was duly posted upon the notice board at the yacht club.

The next day the man discovered that Write, or Curtains, or both, had delivered some collateral damage, as they say in the military. It had shot one of its own troops. The for-sale notice generated by Write had shared a disk area with some weather map images from the DOS-based Listening Post II program. When the man tried to look at the weather pictures, one of them caused the computer to say 'Data Reading Error'.

The man got suspicious, and used a DOS program called DEBUG to investigate the weather picture file. This is like taking an X-ray of a broken leg. And buried inside the weather picture, guess what the man found! A copy of his for-sale notice! Stored there, in error, by you-know-what.

The man became worried. He was trying to give Curtains a fair chance, but he wasn't getting very far. The man decided it was time to formulate a new attitude toward Curtains, given his recent adventures. So he climbed high up onto Mt Wellington as he does every morning, to a place where he could look out over Hobart and much of the civilized world. He sat down on his thinking-rock, where many of his writings had germinated in the past. And this is the new Curtains-policy he came up with:

1. He remembered the earlier message from Curtains about his computer becoming unstable, and decided maybe it wasn't the computer at all, but Curtains itself that was unstable. This was backed up by writings in computer magazines that sung the virtues of Curtains on one page and gave cures for instability on the next.
2. The man makes much of his living writing stories so that the people of the land might be entertained and enlightened. Perhaps, given the state-of-the-art, it would be safest to stick with MS-DOS for the time being. Furthermore he would never again let Curtains files share disk space with his valuable DOS files, lest his story files go kerflooie. This was confirmed by advice from a friend, an author, who won't even let Curtains and DOS files share the same physical disk drive. He has suffered collateral damage to *his* DOS files, too.
3. The man understands that the programs one gets from bulletin boards may not be up to the quality of 'professional applications' bought from computer retailers. Maybe 'professional applications' are more stable. But the man is certainly not going to spend heaps of money for something he doesn't really need, just to find out.
4. The man has noticed that DOS spelled backwards is SOD, and he recognizes that other people's thinking may sometimes be valid, even if it doesn't agree with his. He also notes that a new version of Curtains, claimed to be 'more stable', is coming out in late 1994. He is prepared to look at it with an open mind.
5. The man sees the writing on the wall. He knows that today he can blast out the words for stories and let someone else (the Editor) do the production. But someday, as magazines economize, his stories may have to be submitted complete as 'camera-ready copy'. This is known as 'desktop publishing' and can only be done successfully using Curtains. So the man is going to teach himself to love Curtains, whether he likes it or not... ❖



When I Think Back..

by Neville Williams

More about WA pioneer Wally Coxon and the first broadcast station in the West — 1

In response to our article in the November 1993 issue about Western Australian pioneer Wall Coxon, reader Bill Kelson of Perth has forwarded photostats of a series of articles written by Wall Coxon himself for the *Broadcaster* magazine back in 1939. Recounting his role in the establishmen of radio station 6WF, the story is nicely timed for the 70th anniversary of official public broadcastin in that state.

While the articles detail the problems faced by a remotely sited pioneer broadcaster in 1924, they also shed further light on the career of Wally Coxon himself. Also to hand is a letter from John Caswell, who identifies himself as OIC Radio, Cairns Base, Royal Flying Doctor Service of Australia. John confirms Wally Coxon's link with the RFDS during the Traeger years. From Dave Hanscombe (VK6ATE) of Quinn's Rocks — himself an aspiring historian (see panel) — comes further reference material along similar lines. But more of that later.

To refresh your memory about W.E. (Wally) Coxon, you may need to refer back to page 34 of the November 1993 issue. Very briefly, he was born in the late 1880's and qualified for his experimenter's licence in 1907 — and was hence a near-contemporary of Charles Maclurcan, discussed in the last two issues.

Fortune may not have smiled upon him quite as generously as upon Maclurcan, who had ample resources to pursue his hobby and could do so within easy range of early wireless-equipped ships berthing in Sydney Harbour.

Even so, Wally Coxon built his own receivers and transmitters, used them to establish his own 'firsts' in the sparsely populated west and went on to rally other experimenters, to form what became the WA branch of the WIA (Wireless Institute of Australia).

According to *Western Wireless* magazine (October 29, 1925), Wally operated rotary gap spark equipment before WW1. He became involved in wireless research with the Admiralty during the war and studied valve technology, which he was subsequently able to share with his fellow experimenters.

This group, in turn, broadcast speech and music to attract local listener/experimenters, thereby generating an audience for future public broadcas stations. Unlike Charles Maclurcan however, Wally Coxon subsequently became involved in public broadcasting as the founding Engineer/Manager o Western Australia's first public broadcaster, 6WF.

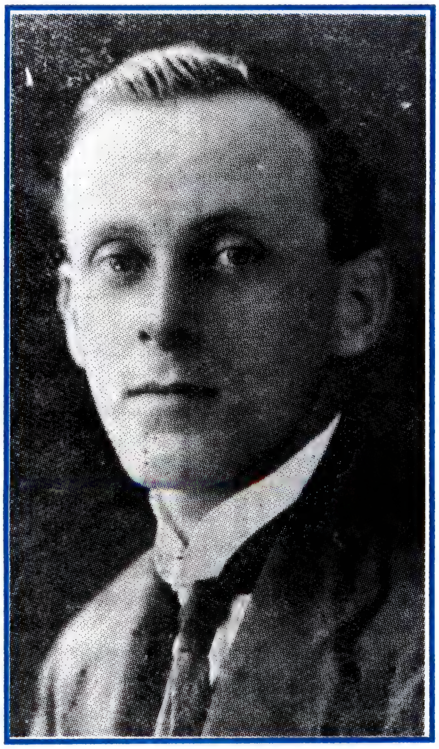


Fig.1: W.E. Coxon, as pictured in 'Western Wireless' magazine (October 28, 1925) in an article 'Wonderful International DX Working — 6AG's Transmitter'.

Told his own story

It was as such that he wrote th series in *The Broadcaster* in 1939 celebrating the station's 15th anniversary. By that time, it ranked as th oldest of 14 broadcast stations ther operating in Western Australia.

In the first of the articles he recalls the pre-professional — amateu — broadcasting era, making mention o A.E. Stevens (6BN) who supplemented his own efforts in Perth (6AG) and C. Cecil (6AB), who broadcast music and the occasional concert for listeners in Kalgoorlie.

The first complete 'live' wireless concert in WA, he says, was organised by the Mt Gawley Club in 1923 and was heard by listeners as far afield as Esperance and Geraldton.

When the Federal Government began planning formal public broadcasting in 1922/3, there was lively debate as to how the costs could best be covered. Having been exposed to the many conflicting implications, Wally Coxon spells out for his 1939 readers the uncertainties they had to cope with, 2000-odd miles from the seat of the political and industrial conniving.

(For a detailed account of events, see Colin Mackinnon's articles in the

December 1993/January 1994 issues entitled 'The Sealed Set Debacle'.)

Ignoring the fascination of 'dial twisting' for pioneer listeners, some contenders favoured an ultra-simplistic solution: a patchwork of listening zones, each with one all-purpose station financed by the Government or by subscriptions from listeners in the area. Others were demanding more than one station per zone: listeners because they wanted a choice of programs; interests like Fisk/AWA because multiple transmitters and more receivers would generate more sales and revenue from patents and royalties.

Government's mistake

In May 1923 the Federal Government adopted a compromise plan unique to Australia: multiple stations in each region would offer competing programs, but receivers would be individually 'sealed' to limit reception to those stations for which individual households had paid a specified fee.

Listeners could use multiple receivers — each locked to a different station — or a single special receiver 'doctored' (somehow!) to tune specified stations only.

The scheme would be administered by the PMG's Dept, who would license broadcast stations at their discretion, issue listeners' licences and ensure that individual receivers could be tuned only to the stations for which listeners had paid the nominated fee. The Department would type-approve all receivers before they could be offered for sale, both in respect to the method of sealing and to ensure that they would not radiate spurious oscillation.

Unfortunately, the scheme was seriously flawed, being the end-product of political extremity rather than practical common sense:

1. Having in mind the multi-station option, there was really no routine tamper-proof way of sealing and/or re-sealing normal receivers as licences were issued or altered.
2. The responsibility for improvising 'sealable' receivers rested squarely on local manufacturers. There would be no competition from overseas to keep the lid on prices.
3. The task facing the PMG's Dept would have been horrendous, as also would the administration costs, on top of the station fees.
4. Rather than be identified by an unacceptable licensing system, many listeners decided either to defy the law by using an unsealed receiver or simply to 'opt out' of wireless for the time being.

Amateur Radio in Western Australia.

May I ask you and your regular readers for help?

I have set myself the task of (hopefully) writing a history of the development of Amateur Radio in Western Australia — a subject inevitably destined to inclide commercial radio, telegraphy, VIP and coastal radio, as well as other areas in which amateurs (especially the earlier experimenters) were to become involved.

Having read with interest a number of historical 'snips' in past issues of EA, I am on the lookout for old QSL cards, references/info from other sources or anecdotal accounts of VK6s. If we do not collect this info soon, it may be lost forever.

(From Dave Hanscomb VK6ATE, Certificate Manager RFDS Award, PO Box 39, Quinn's Rocks, WA 6030, Australia).

Two classes of station

Such was the opposition to the scheme that, within a few months, in July 1924, the Federal Government dumped it and settled for an 'open' system of A-class stations supported by compulsory listeners' licences and B-class supported by advertising revenue. Licensees were free to listen to any station as they so chose.

At the outset, when Westralian Farmers in Perth had been considering applying for a licence, their reasoning was that, as a co-operative enterprise with 6000 farmer/shareholders on their books, they had a ready-made audience for a program emphasising market reports, news, weather and talks.

So, when issued with Perth's first (and only) licence, they pushed ahead with the project — only to be unsettled when the case for one 'general' station per zone appeared to be gathering momentum.

Such a policy would have conflicted with their proposed rural emphasis and, with the station more than halfway to completion, WF's management had to decide whether to call a halt, or take a punt that things would work out. Nor did the Company's problems end there, according to Wally Coxon. When the sealed set scheme prevailed, not only were prospective listeners estranged but no ready supply of type-approved 'sealable' receivers was available in Perth from either local or overseas manufacturers.

The management at Westralian Farmers faced the impasse of setting up a 5kW station to serve 6000 identifiable customer families, but with no reliable way of supplying them with legally acceptable receivers. So they decided to 'roll their own', resulting in the Westralian Farmers 'Mulgaphone' — surely the most ocker title ever allocated to a wireless receiver!

Their planning at this stage envisaged a workshop with about a dozen employees, assembling receivers from a mix of imported components and items made on the spot.

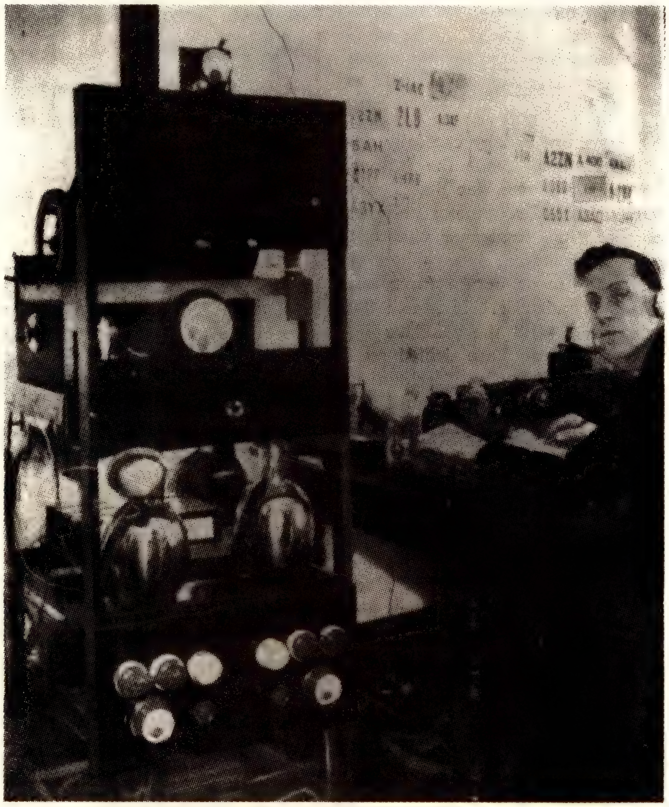


Fig.2: Also from 'Western Wireless' in 1925, this ancient print shows Wally Coxon with his short-wave transmitter and receiver. On 30-odd metres he had contacted eastern Australia including 2CM, New Zealand, America, Africa and Europe.

They would be produced in batches of 30 - 50, primarily for WF's own customers.

Pay up and shut up!

Available in a choice of cabinets, the basic design would involve two valves and a crystal detector — dictated in part by the fact that AWA were demanding 10/- or more per valve socket to cover patent royalties. Whether such claims were justified was open to some doubt, according to Wally Coxon, but that did not deter AWA from asserting them in no uncertain fashion:

'The licensee will not during the subsistence of this licence impeach, dispute or in any way question or assist any other person or persons or company to impeach, dispute or question the validity or subsistence of any of the said Letters Patent owned or controlled by the Company relating to electric or wireless apparatus'.

While Westralian Farmers chose not to make an issue of the matter, Wally Coxon said that AWA's royalty claims were honoured more in the breach than the observance by 'backyard assemblers' and home constructors. In fact, he continues, the same cavalier attitude was adopted to wireless licence fees, even after the sealed set scheme was dropped.

Attempts were made by the PMG to pressure dealers not to supply receivers or components unless the intending purchasers could produce a current listener's licence. At the very least, they were supposed to record the names and addresses of anyone purchasing a complete receiver, or key components to build one.

Far from complying, some dealers let it be known that they would supply receivers and components free from such constraints. It would appear that the first batch of 'Mulgaphones' were designed to cover only 6WF's wavelength of 1250 metres (240kHz), with a 10% allowance to cater for possible frequency drift. As such, they would presumably have been acceptable in WA, with fixed coils and a tuning capacitor giving only limited coverage centred on the sole local station.

Getting 6WF to air

Looking ahead to the full 'sealed set' situation, Westralian Farmers would have faced the same imponderable design problems as other aspiring manufacturers. Great was their relief therefore when the scheme was abandoned soon after 6WF came on air, and they were free to sell locally made or imported receivers covering the long and/or medium wave bands.

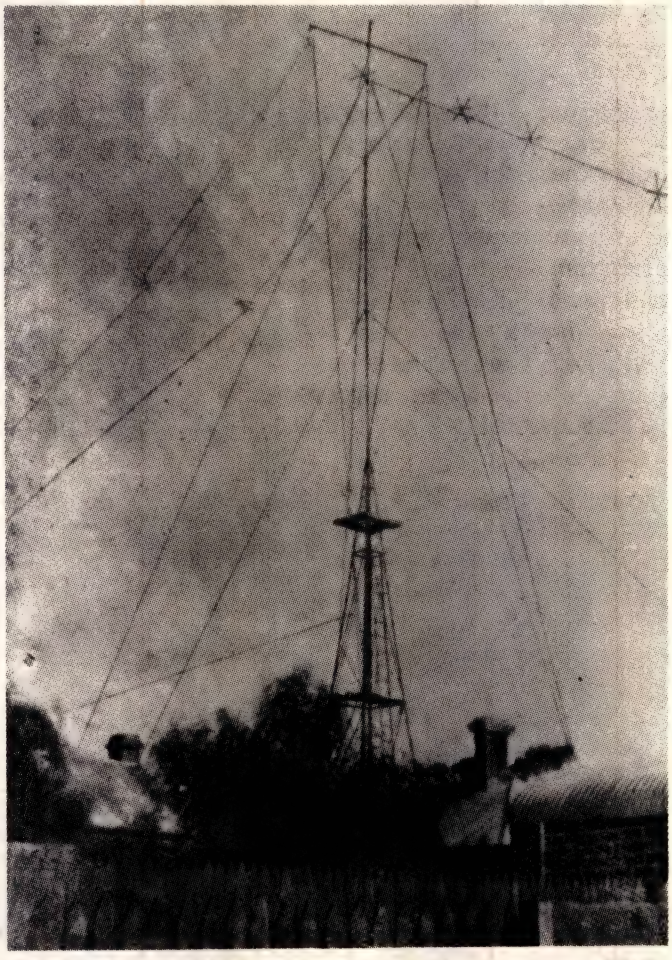


Fig.3: At best, an impression of the antenna array at Wally Coxon's 6AG — a maze of wires strung from the top of a guyed steel mast atop a large windmill type tower, which dwarfs the house.

Wally Coxon says that Westralian Farmers had set up a receiver in their showroom well before signals were available from 6WF on the floor above. Instead the receiver was tuned to his own amateur transmitter, and it fell to his lot from time to time to announce and play a few records to support prearranged demonstrations.

One publican, he recalls, became quite excited at the prospect of being able to offer music and race results to his Saturday afternoon customers. He demanded to be shown how to switc the wireless on and off, tune in a statio and make the sound louder or softer. B his final question stumped them: "Ho do you make it (the race call?) go fast or slower?"

As completed in 1924, 6WF proved major undertaking for a mere 'co-op store. The transmitter room and studi were installed on the top floor of the existing building, the studio being fitte with double doors and double-glaze windows to minimise extraneous noise.

The walls were packed with a 3 (7.6cm) layer of shavings faced on the inside with galvanised iron sheets and layer of Celotex, plus decorative drapes. It measured som 26 x 16ft (8m x 5m), and th studio was fan-ventilated wit 'washed' air through floo and ceiling ducts, wit provision to add ice to th cooling water when necessary. (A second, small studi was added later to facilitat continuity of presentation).

Aerial on the roof

To support the aerial on th roof, the structure had to b strengthened to cope with tw tubular steel masts, each 95 (29m) high, stabilised b cross-arms and guy wires The gross weight was abou six tons.

Due to the proximity of th transmitter and aerial system the microphone and associated wiring in the studi had to be complete shielded. Transmitter powe at the outset was 500 watt and it was some months, according to Wally Coxon before the 5kW output stag was added.

At switch-on, 6WF on 125 metres shared the Australia airwaves with 2FC on 110 metres and 2BL on 35 metres, both in Sydney. Some time late 3LO Melbourne appeared — also o 1250 metres initially, it seems. Behin the disparity in wavelengths lay spirited argument in the industry abou the merits of longer and shorte wavelengths which was described at th time, according to Wally Coxon, as 'th battle of the waves'.

As far as listeners were concerned, was mirrored by the use of plug-in coil (usually of the 'basket weave' o 'honeycomb' type) which made it possible to change the receiver tuning range as required.

The 'battle' continued until the PMG's Dept was empowered to implement a decision which forced all Australian stations to move to allocated wavelengths — or frequencies — in what became the present medium-wave AM broadcast band.

But back in 1924, in all good faith, 6WF went to air on 1250 metres with a licence which stipulated 'a program format to cover all tastes'.

They could include advertising of up to 30 minutes per session, but were forbidden to discriminate between advertisers. In fact, paid advertising in the early days of 6WF seldom exceeded one minute/session!

Studio professionals

If the management of 6WF had bitten off 'as much as they could chew' in setting up the station, preparing for everyday operation was no snack, either!

Initially, they could second impromptu help from the staff on site involved in the production of 'Mulgaphones', but as the opening day approached they realised that 6WF would need its own specialist staff with the imagination and ability to attract an audience as the only local station on air.

Without mentioning his own role, Wally Coxon pays tribute to 6WF's management for their choice of operators to assist him on the technical side: George ('Jack') Sutherland and Frank Elliott.

Trained as operators in the British Navy, both had migrated to WA with the idea of going on the land. But when presented with a possible alternative, both decided in favour of the skills they had already acquired.

For the studios, A.J. Leckie Mus. Bach. was made responsible for the musical side of the programming, while Harold Wells was appointed as announcer, with Evelyn Willis ARCM as accompanist.

The station was officially opened on June 4, 1924 by Premier Mr P. Collier, before an audience of 500 people assembled in the Social Hall of Westralian Farmers on the floor below the studio.

The radio audience for the occasion included 200-odd families who had purchased 'Mulgaphones', plus as many others who had been able to modify their mainly home-made receivers intended originally to listen to the amateurs on 200 - 400 metres.

In his address Mr Collier, as a politician, professed support for wireless on the grounds that, if his listeners tried to interject, neither he nor anybody else could hear them!

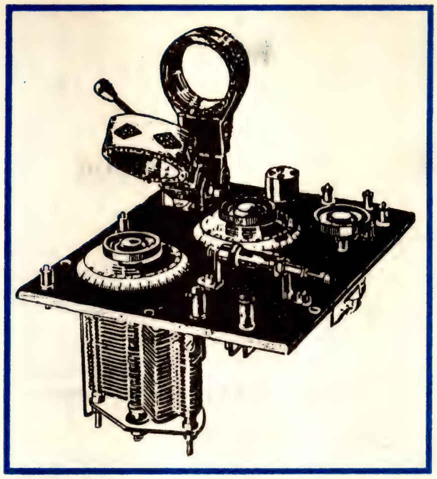


Fig.4: Described as 'A special offer for State School Boys only' the parts to build this basic receiver were advertised by Westralian Farmers on the cover of 'Western Wireless' (October 25, 1925) for £2/5/-.

Subscribers & 'pirates'

As already noted, Wally Coxon says

Program of Station 6WF (1250m) for Tuesday, November 2, 1925

12.30	Tune in.
12.35	Musical Items.
12.47	Markets, News, Cables, Weather Reports.
1.0	Time Signal from the Perth Observatory.
1.1	Items from the Studio Orchestra's Repertoire.
2.0	Results from the Melbourne Cup, Close Down.
3.30	Tune in.
3.35	Pianoforte Selections by Mr Ron Moyle ATCL to:
4.0	Items from the Studio Quintette's Repertoire.
4.30	Close Down.
7.0	Tune in.
7.5	Children's Corner.
7.30	Markets, News, Cables and Weather Reports.
	Concert Night
8.0	Address by Lord Burnham (President of the Empire Press Conference) from Queen's Hall.
8.45	Vocal Iyems by Wendowie Quartet. Mr Rhys Francis, Tenor.
9.30	Lecturette by Dr J.S. Battye, BA, LL.B.

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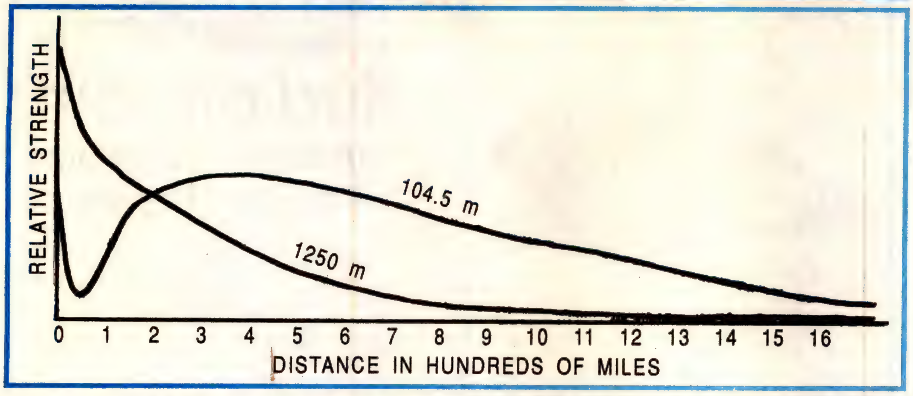


Fig.5: From 'The Western Wireless', a plot of the relative strength of signals against distance in hundreds of miles, from the long and short-wave transmitters operated by 6WF.

that 6WF had no sooner commenced broadcasting than the sealed set scheme was scrapped, giving way to licence fees payable to the PMG's Dept. Things were complex at first, but subsequently rationalised to the relief of all concerned.

As in other states, he says, most listeners in WA country areas took out licences, if only because the presence of a mandatory outdoor aerial was a dead give-away to local postmasters and village 'dobbers'.

In urban areas, it was commonly possible to get by with an indoor antenna or even contrive to pick up signals from the power mains.

In 1925, for example, licences in the Perth area totalled 1200, yet one firm alone had sold 4000 'Ducon' adaptor plugs, designed to provide a mains/aerial connection. The assumption at 6WF was that 85% of their audience in the Perth area were 'pirates', which prompted announcer Harold Wells to address them on occasions as "Good afternoon, subscribers and listeners".

Wally says that, based largely on subscribers' letters, they had to work out for themselves what was meant by a 'general interest program format to the satisfaction of the Postmaster General'.

Subject to certain time restrictions, they had access to news by arrangement with the Australian Press Association, Reuters and the Perth daily papers. They could also borrow gramophone records in exchange for publicity, such that they had no station record library and rarely more than 20 or 30 records on site at any one time — a situation that would have been unthinkable in 1939.

Back in the mid-1920's, however, 6WF listeners showed a marked preference for 'live' broadcasts, which posed a major problem because of the city's remoteness from major cultural centres and its limited telephone access. They therefore had to rely heavily on local personalities and artists, in particular those prepared to 'drop everything and help out in a program emergency'.

'Yer gotta laugh'

In the circumstances it wasn't always possible to observe the niceties of programming, as when inadvertent repetition of a recording of 'I Look Into Your Garden' brought comment that listeners disliked having vocalists peering too frequently over their garden wall!

On another memorable occasion, a stand-in guest speaker was part-way through his talk when a gong sounded in the studio, operated remotely from the Observatory as an on-the-hour time signal.

With no prior warning and thinking he had been 'gonged', the speaker apologised to his listeners for exceeding his allotted time, picked up his papers and headed for the door. He had to be intercepted and re-introduced by the duty announcer to complete his address!

Among letters of complaint when they had to suspend temporarily a Saturday afternoon session came on which commended the decision. The correspondent said that he would now be able to do other things without fear of missing something interesting!

The technical naivety of the population at the time was illustrated by a minister of religion who bustled into the studio with a letter addressed to a distant mission field. He wanted it sent by 'aerial mail'!

In part V of his series of articles, Wally Coxon repeats the tale of the Perth Town Hall clock appearing to strike a 24-hour midday, as in th original November 1993 article. H adds that the traffic noises picked up b the microphone in the Town Hall Tow proved to be of interest to country listeners by way of City 'atmosphere' From time to time announcers wer even despatched to the site, to add word picture of what was going on!

In the matter of atmosphere one o 6WF's popular sessions in the earl days was a musical 'afternoon te party', where visiting artists were broadcast against a background of audienc noise and the clatter of teacups.

On the technical side

1926 saw the introduction of overseas rebroadcasts via short waves, as we now understand them. The first for 6WF involved Wally Coxon's own station and a New Zealand amateur.

This was followed by a number of rebroadcasts from 2XAF, an experimental station operated by the General Electric Company at Schenectady, USA. Received between 6.30 and 8.30am, planned broadcasts would often include greetings and news of interest to WA listeners.

PCE, the Philips station in Eindhoven Holland, was also putting a good signal into WA and Wally Coxon, with other station staff, often spent long nights compiling reception reports for this and other stations.

In June 1926, by arrangement, PCE re-broadcast a signal picked up from the BBC — enabling 6WF listeners to enjoy a concert from London, along with the chimes of Big Ben.

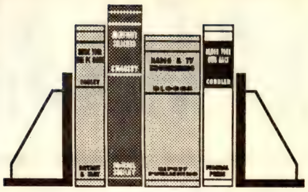
Wally says that 6WF's initiatives in the area gained it a reputation for its contributution to short-wave technology, and added to pressure on the British Government to become active in Empire broadcasting.

6WF added directly to propagation technology by installing a second transmitter to supplement the main transmission — and hopefully involving much less power. The main 1250m transmitter, according to Coxon, gave excellent daytime coverage but could be compromised at night by distant thunderstorm activity.

Using a quartz crystal imported from the UK, 6WF set up a supplementary 200-watt transmitter on 104.5m — Australia's first crystal controlled broadcast transmitter. It operated for several years and clearly outperformed the long-wave transmitter at night, for ranges between a couple of hundred and a couple of thousand miles. (See graph).

(To be continued) ❖

NEW BOOKS



Update on HDTV

HDTV: High Definition Television, by Stan Prentiss, Second Edition. Published by Tab/McGraw-Hill, 1994. Soft covers, 234 x 187mm, 322 pages. ISBN 0-8306-4295-1. RRP $36.95.

The future of TV is now virtually certain to include high definition transmissions, and to be in the digital domain. But unless you're one of the experts working directly in this area, it's hard to keep up with the developments in either the technical or 'global politics' aspects of this technology. That's where this book is designed to help.

The author is well-known US technical author Stan Prentiss, and his first edition gave a good introduction to both the technical and political sides of HDTV. But things have been developing so rapidly that he has produced this second edition to bring it up to date — or as close to it as any book can be, nowadays. There's a final chapter discussing the FCC/ATS Committee decision in May last year, for example, and he summarises the formation of the 'Grand Alliance'. He also talks about the significance and relevance of MPEG2.

Mr Prentiss has managed to gather together a huge amount of good 'meaty' technical information on the systems which have led to what now looks like being the 'final' HDTV system — at least for the USA, if not the world. He also provides a great deal of background on the politics, the testing programs adopted for the various competing systems, and the results achieved.

In short, my impression is that this edition provides an excellent reference on the subject. If you want an update on HDTV technology, this is a good one.

The review copy came from McGraw-Hill Australia, of 4 Barcoo Street, Roseville 2069; phone (02) 417 4288. However it should be available from all larger and technical bookstores. (J.R.)

Sound Blaster books

SOUND BLASTER: The Official Book, by Richard Heimlich, David Golden et al. Published by Osborne/McGraw-Hill, 1993. Soft covers, 234 x 187mm, 480 pages, with 3.5" floppy disk containing digitised sound samples, MIDI music files and software utilities. ISBN 0-07-881907-5. RRP $59.95.

THE ULTIMATE SOUND BLASTER BOOK, by Martin L. Moore. Published by Que Corporation, 1993. Soft covers, 234 x 187mm, 399 pages, with two 3.5" floppy disks containing sound sample and MIDI music files, multimedia demos, shareware utilities and 'trial' versions of sound wave editors and MIDI sequencers, etc. ISBN 1-56529-298-7. RRP $71.95.

In the five years since the original Sound Blaster sound card was released for the PC, it has evolved into a complete family of such devices and thrust its developer Creative Labs into the forefront of the PC-based 'multimedia' revolution. Sound Blaster cards are now by far the most popular, and the *de facto* standard as far as a lot of DOS-based software is concerned. And with so many people now wanting to delve deeper into multimedia applications, it was inevitable that the need would arise for books providing more information than is provided in the card 'user manuals'. Both of these books are designed to meet this need.

The first book, by Heimlich *et al*, is pretty comprehensive, covering just about everything from installing the various Sound Blaster cards and their software, through their standard hardware and software features and functions, to troubleshooting and programming tips. There's also a survey of many of the hardware accessories, such as active speaker sets and MIDI adaptors, etc., and compatible third-party software.

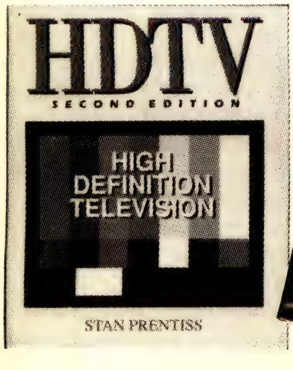
The text of this book is well organised, clearly written and adequately illustrated. The material on programming is perhaps a little sketchy in places, though, and it's more a good introductory text rather than one which carries you the full distance. The software and files on its 3.5" floppy are a bit the same way: good for starters, but perhaps a little unsatisfying in total.

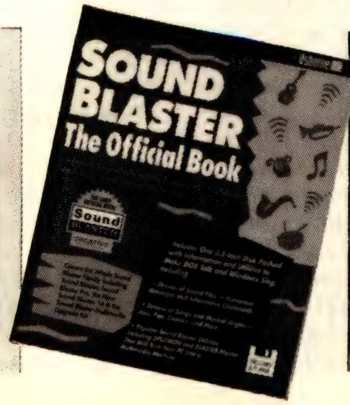
The Moore book is similar to the first in terms of comprehensive coverage of the Sound Blaster family hardware and support software. But it also goes somewhat deeper into programming, and will probably be found more satisfying by those who like to 'roll their own' software rather than relying on the standard packages. There's even a schematic for a simple MIDI breakout box, too, whereas the first book simply assumes you'll buy the official Sound Blaster adapter cable.

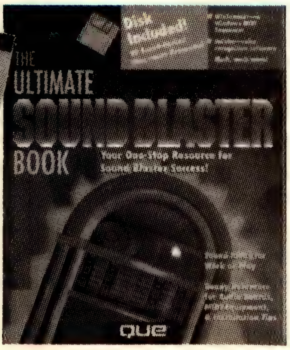
Those who are as yet not fully 'up to speed' with sound digitising, MIDI, sequencing and the other basic concepts will probably also find this book a little more helpful, because it devotes more space to explaining them. And finally it does provide rather more useful information on the two included 3.5" floppies — including demo versions of MIDI sequencer program *WinJammer*, speech recognition package *InCube*, and *Wave Editor*, a sound file editor.

Either book would make a good introduction to Sound Blasters and their use, but those wanting to go deeper and further will probably want to go for the (more expensive) one by Moore.

Both review copies came from Dick Smith Electronics, which stocks them as Cat. Nos. B-6710 and B-6712 respectively. (J.R.) ❖



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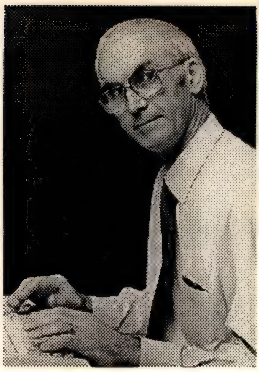
FORUM

Conducted by Jim Rowe



Audio testing, capacitor sound, and that naughty phone barring circuit...

I have some interesting letters for you this month, including a couple which suggest that as well as merely acting as 'conductor' of the discussions in this column, I should be carrying out tests to resolve some of the questions 'once and for all'. But is *that* the idea of this column? The suggestion also seems to assume that there's always a 'cut and dried' answer to all of the things we discuss here — which is unlikely, I suspect.

The first letter off the stack comes from Mr Bob Jeffery SMIREE, of Bongaree in Queensland, who was laboratory manager in the Department of Physics at Queensland Unit, before he retired. Mr Jeffery is buying into the discussion on 'capacitor sound', although he basically seems to take the view that we're all waffling around in circles, rather than trying to resolve the matter. As you can see for yourself, he also makes a comment about that German experiment to determine if people could tell the difference between CDs and vinyl recordings of the same basic programme material:

In the November issue of EA, you published an extract from the 'New Scientist' which was about tests carried out in Germany. It showed conclusively that people accustomed to listening to music could not reliably tell the difference between CDs and vinyl records. Furthermore, it did not seem to matter whether a very high quality audio set up or an average audio set up was used. The score rate was the same for both set ups. The conclusion was the most interesting part — listeners heard what they expected to hear!

This is in accord with my letter of 24th September, in which I stated that a double blind test of two otherwise identical amplifiers, one with ordinary capacitors, the other with polystyrene capacitors, is essential to prove or disprove that replacing ordinary capacitors with polystyrene capacitors changes (improves?) audio quality. The German experiment proves what I said — if you change the capacitors in an amplifier expecting to improve the audio quality, you will hear an improvement in quality, so that those who say 'Try it and see' are not proving a thing.

You appeared to agree with the report on the German tests mentioned above, and I had expected that this would end the discussion on capacitors and similar items based on what someone or other alleged he could hear, and on theory which may or may not be either relevant or correct. Yet in 'Forum' in the January issue of EA, you continue the discussion on the relative merits of various capacitors in audio amplifiers on the basis of theoretical articles in other magazines, and on a test which may or may not be relevant to use of various types of capacitors in audio amplifiers.

How many teeth?

Because of this, I am reminded of the story of the ancient Greek philosophers who spent all night arguing about the number of teeth a horse had. Not having reached any conclusion as dawn broke, they called in the head slave to see if he could assist. After listening to all their arguments, the head slave went out into the stables, opened a horse's mouth, counted the teeth, and settled the argument which had raged all night. It seems to me that your situation is essentially that of the ancient Greek philosophers. If you did a few practical tests along the lines I suggested, there would be no need for all this discussion about the relative merits of various capacitors.

On the other hand, it is possible that you are enjoying a joke at the expense of those who wish to argue about theory, rather than conduct a few practical tests to prove or disprove their statements. If this is the case, jolly good luck to you.

To get back to 'Forum', January issue. Anyone who has studied psychological testing, especially as used to evaluate the suitability of people for various jobs, knows that there are two most important assets of any test: reliability and validity. Reliability is the degree to which a test measures consistently whatever it does measure, or, if you like it in other words, the extent to which others carrying out the same test achieve the same results. Validity refers to the degree to which the test is capable of achieving the aims or purposes it is intended to serve. In other words, the validity of a test is the extent to which a test designed to measure X actually does measure X, rather than Y.

Transferring these terms to the capacitor test circuit used by Walter Jung and John Curl, there is no doubt — the test is reliable. It measures consistently whatever it does measure. But is it a valid test? Do the test results actually mean anything in terms of performance of various capacitors in an audio amplifier? Dr Hawksford points out that the Jung/Curl test uses a very simplified model for the capacitors, and suggests improvements.

But as far as I can see, all the test does is show the differences between electrolytic, tantalum, ceramic, polyester and polystyrene capacitors. Normally, this can be found out quite easily by reading the capacitor maker's data sheets, and by using a reasonably decent LCR bridge. No one is reported as having conducted tests (preferably double blind tests) to see if the Jung/Curl test is meaningful in terms of audio quality.

Mike Hammer quite obviously believes that the test is valid — that results from the capacitor test circuit translate directly into audio quality. I am prepared to believe that this is so and that the test is valid — IF Mike Hammer or EA carries out a double blind test along the lines I suggested earlier, and can quote accurate figures to support this thesis.

As far as I can see, everyone is still

acting like the ancient Greek philosophers — sitting round and arguing about the matter. I am still waiting for the head slave to come and count the horse's teeth.

Thanks for those comments, Mr Jeffery, and I can certainly sense your irritation at all this emulation of the apocryphal Greek philosophers. (Actually I thought they were arguing about the number of teeth that women had, compared to men — which would have been even easier to check... it doesn't matter, I guess!) But really, I think you're mistaking the whole idea of this Forum column.

The column is primarily to provide a place in the magazine where matters of technical interest can be discussed, and where as many readers as possible can have their say. Certainly we have an interest in finding the 'objective truth' regarding the matters we discuss — but often there can be many different views as to where that truth may lie, or even whether there is one at all.

Perhaps you might agree that even 'objective' technical questions are frequently capable of different interpretations, and often more than one of these has a legitimate claim to being valid. This means that resolving them is rarely as simple as opening a mouth and counting the teeth inside. If only they were!

By the way, I certainly don't sit here behind the scenes, guffawing away at the ideas suggested by readers. Sometimes I might be guilty of the odd chuckle or smirk, but generally I try to be an impartial 'conductor' — involved in a general kind of way, but mainly striving to make sure that Forum not only makes interesting reading, but also presents each point of view as clearly as possible, so readers can make up their own minds.

The 'chief slave'

You also seem to suggest that I should somehow act as the 'chief slave', and carry out whatever tests or experiments are necessary (in your own , or someone else's opinion) to resolve each matter 'once and for all'. Frankly, I don't believe that's my role at all, in this column.

If readers are motivated to conduct tests and experiments to try and resolve some of the matters we discuss, that's fine; I'll be happy to publish the results. But if not, I don't see the responsibility for doing so necessarily falling back at my own feet. I'm the referee here, folks, not one of the players!

Moving on, then, but still on the basic subject of 'capacitor sound', this brief faxed message arrived from Mr David Millist, of Dalby in Queenland:

Just a quick note on distortion by capacitors. About 15 years ago, while building a test instrument that contained several analog computer stages, I came across a related problem. I couldn't calibrate the unit and was getting up to 10% variation depending on the input voltage. Finally after a couple of frustrating days, I happened to notice that the output on one of the integrators was not quite linear for a constant input voltage. It could be seen on the storage scope I was using.

After further frustration as to the cause, I changed the capacitor to a different type. The problem was instantly fixed. Only after removing all of that type of capacitor did the circuit calibrate correctly. The frequencies and currents involved were all less than 50 hertz and 1mA, so I'm sure that no internal resistance was involved. My conclusion was that the capacitance changed up to 10% between one and 10 volts.

As to the offending capacitor's type, all I know is we referred to them as 'Greencaps' and they were similar to look at, if not the same as some present metallised polyester film capacitors.

Hmmm; that's interesting, David. I

haven't heard of other people having this kind of trouble with metallised polyester caps — green or otherwise — but your comments may prompt others to offer their experiences in this respect. I suppose it's always possible that you struck some from a bad batch...

Rectifying electros?

Still on the subject of capacitors and audio, another fax arrived from Mr Doug Rickard of Upper Coomera, also in Queensland (what is it about Queenslanders and capacitors?). Doug is a Senior Technology Consultant with a computer firm called Software Technologies, and has some information on the behaviour of electrolytic capacitors.

I guess by now just about everyone knows that poor old electros are not a good choice as audio coupling capacitors, due to their high leakage current quite apart from anything else. They also have a reputation for introducing various kinds of distortion, and there have been several theories regarding the cause of this distortion — not all of them totally convincing.

It's this subject that Doug Rickard seeks to clarify, and although few people would seriously consider using electros in an amplifier's signal path nowadays, I think you might still find what he says of interest:

Jim, just to add a little more fuel to the fire on the subject of capacitors...

In about 1960 I worked as an Engineer with the Dubilier Capacitor Company in London. My job was the design and maintenance of the production line test equipment used in the manufacture of capacitors and resistors.

Electrolytic capacitors using aluminium foil exhibited a number of interesting characteristics. The first was that the actual capacitance was an inverse function of the working voltage. After fabrication, electrolytic capacitors go through a 'forming' process. It is this forming which establishes the oxide dielectric. The thickness of the oxide, and hence its voltage rating, seemed to be a function of the final forming voltage. For example, if a particular capacitor assembly was 'formed' for 200 volt working operation, it would have less capacitance than a similar assembly 'formed' for 50 volt working operation.

If an electrolytic capacitor was operated on a voltage much below its rated working voltage, then in time the specified working voltage would drop. If then a higher voltage, but still less than the original manufactured working voltage was applied, the capacitor would fail. To re-establish the initial rated working voltage the capacitor had to go through the forming process again.

So rule one is, always operate electrolytic capacitors at or near their rated working voltage. Electrolytic capacitors kept in storage for long periods may also need to be re-formed before being put into use.

Electrolytic capacitors are often rated at -10%,+100% of rated capacitance. This is due not only to the normal spread in manufacture, but also the phenomenon mention above. Also these aluminium electrolytic capacitors could exhibit differing effective capacitance depending upon the impressed DC voltage.

Most of the test equipment for electrolytic capacitors used a 50Hz test signal, derived of course from the mains. One of the tests I did was to measure the effective capacitance as the DC voltage was changed. After I had observed the effect, I reasoned that a slowly varying DC was just another AC signal. So then I tried different combinations of frequencies and voltages, and measured the effective capacitance at each frequency.

I soon established that there was an upper frequency for the lower of the two signals, beyond which the effective capacitance for the upper frequency remained constant. My conclusion was that there was some chemical effect taking place at the lower frequencies, which seemed to change the effective capacitance. This chemical effect had a maximum rate at which it could take place. Once this rate was exceeded the capacitor started to behave more like the theoretical capacitor.

I believe it is this effect which is often ascribed to as the 'rectifying' characteristic of electrolytic capacitors. It also means that when a wide range of frequencies is to be passed through an electrolytic capacitor, if some of those frequencies are below the limiting frequency of the chemical effect, then the effective capacitance of the capacitor at the higher frequencies will be affected. This explains to some degree the non-linear and cross-modulation effects often experienced with electrolytic capacitors.

Many type of capacitors can also exhibit a 'memory' effect. It is often observed after a previously charged capacitor is discharged by shorting the terminals. Some short time later, a voltage can be measured across the terminals. This effect has often been observed with electrolytic capacitors, but in some cases I have found it to be more pronounced with plastic capacitors. Experiments with large value Mylar capacitors have shown them to be particularly subject to this phenomenon.

Some of the early S-band (2300MHz) phase-locked ground based receivers used by NASA had a loop bandwidth of about 1/12Hz. This was achieved by the use of a large, VERY EXPENSIVE 180uF Mylar capacitor. Sometimes it was noted that the receivers would experience a degree of frequency drift if ever a step change in frequency was made.

Finally I took one of the capacitors and charged it to about 12 volts for more than an hour. The capacitor was then shorted for 60 seconds with a heavy copper lead. The short was then removed, and a very high impedance electrostatic voltmeter was connected across the terminals. Sure enough, after about 10 minutes about 1V was measured.

Apparently this effect is due to a phenomenon of the dielectric slowly relaxing. Such an effect however must surely lead to other idiosyncrasies in the behaviour of plastic capacitors, and set frequency restrictions on the use of these capacitors.

Ceramic capacitors can often exhibit a 'piezo' effect. I have experienced this in two situations. The source of microphonics in a very high gain valve audio amplifier of 'R,TV&H' design was found to be a 'Ducon' ceramic capacitor in the input stage of the amplifier. Replacing that capacitor with similar ceramic capacitors still gave the same effect, but replacing it with a paper capacitor completely solved the problem.

Similarly, high voltage ceramic capacitors were used in an epoxy potted EHT filter assembly. Time after time the capacitors were failing. Inspection showed the capacitors to be actually fractured. Similar assemblies but without the potting showed no problems. The conclusion was that ceramic capacitors subject to high voltages must be allowed to have some freedom of mechanical movement, to prevent the minute movement due to the piezo effect from fracturing the capacitor. The use of a flexible potting compound is recommended.

I have heard of, but not experienced it myself, plastic capacitors becoming microphonic when compressed in a plastic mounting clamp, but becoming non-microphonic when the clamp was loosened.

As the man once said, 'Capacitors ain't always capacitors...'

Thanks for those comments too, Doug. As I said earlier, most amplifier designers avoid using electros in the signal path nowadays, so your information on their non-linear behaviour is perhaps a little away from the current topic. But your comments about 'memory effects' in mylar caps are surely of direct relevance, it seems to me, because mylars are one of the types often regarded by the 'golden eared' purists as superior to common-garden types like metallised polyesters.

PABX barring

Now let's change the subject from capacitors and audio, to make a brief return to the subject of STD barring, PABX's etc. You may recall that in our October 1993 issue, we published a small item in the 'Circuit and Design Ideas' section — a circuit to prevent unauthorised STD and ISD calls from a domestic phone. The circuit turned out to have a serious shortcoming: if not disabled, it prevented anyone making '000' calls to emergency services.

Many people rushed to point this problem out to us, with varying degrees of admonition for our mistake in publishing the item concerned. I commented on this in the January column, and apologised for the mistake. However it's perhaps not surprising that letters and faxes have continued to roll in — some still in response to the original item, and others critical of some of the comments I made in January. It seems some readers won't accept anything less that yours truly receiving a public flogging, plus demotion right back to a D-grade journo!

One comment I made in January was to speculate whether this problem might exist with PABXs, which are often also programmed to prevent unauthorised STD and ISD calls. This comment triggered off quite a few letters in itself, many pointing out (a) that modern PABXs are computer controlled, and can easily be programmed to allow '000' and other permitted call codes, while still preventing STD and ISD code prefixes; and (b) that Austel regulations make it illegal for a PABX to be programmed to prevent '000' calls, in any case.

One or two people also suggested that I should again have 'opened the horse's mouth and counted the teeth' — like the writer of the next letter, as you'll see. It comes from Mr Gordon Wormald, of Florey in the ACT, and Gordon also takes the opportunity to comment about component availability and supplier's willingness to supply small quantities:

I suppose that, you are sometimes short of time, otherwise you would not be falling back on 'I imagine...' or 'Presumably...' as a substitute for supplying the facts of code-barring practice in PABXs. However, it would take you less than a minute to find your equipment's response to dialling (0)000; so perhaps you may get around to it sometime and then let interested readers like me know the result.

My guess is that modern PABXs are so heavily involved with listing and using data in their system memory that there is no problem at all in their analysing public network 0-level calls to a depth of three or four digits for access analysis. This could allow all callers to reach Emergency (000), Directory Assistance (013) and other services, while barring general access to STD or ISD. What is actually permitted in any particular PABX is more likely to be the result of the Communications Manager's attitude to call-barring than of equipment limitations.

By the way, your description of manufacturers' (and distributors') attitude to the 'lollypop' end of the market is not confined to electronic products. It is readily visible in chemicals and tools, and I have heard of others. As an instance, I needed a moulding release agent for a rather unusual application. Several large firms refused to discuss the matter as soon as it became obvious that only a small quantity was involved. However, one tried to help : Yes, they had a compound that 'almost certainly' would do the job. Some discussion of its chemistry raised doubts in my mind, as it seemed somewhat similar to a couple of silicone oils that had failed in tests, so I asked if I could get a millilitre or so for a test. "Sorry, the minimum order is a dozen cans, for $284 (ex tax)." After one squirt, I could have been left with the rest useless.

I was lucky — I found a small specialist firm whose proprietor was cheerfully cooperative to the point of providing (free!) samples of two agents, one of which works for my problem. This enabled me to salvage a part-time manufacturing operation, which looked like being abandoned for lack of this technological fix.

Thanks for your comments, Gordon. By the way, the reason why I hadn't tried dialling '0-000' in the office is that I didn't want to be responsible for causing a nuisance 'just testing' call to the emergency services.

I've since found out from our company Communications Manager that the PABX *does* allow '0-000' outward calls to the emergency services, as you and others have predicted. So I was wrong in that speculation, too; sorry about that, everyone.

It's interesting to learn that the electronics industry is not the only one with firms who won't help with 'small' orders and requests for samples. I'm sure that all of these firms have their reasons for this, and that *they* find their actions justified. However in my opinion it's all a symptom of the general complacency and inertia that seems to have infected so many Australian firms.

Frankly, I suspect this problem is one of the underlying reasons why so much of Australia's manufacturing industry has fared so badly compared with many of the countries to our North, and even in comparison with the USA. But I could be wrong — if you believe I am, write in and tell me why. In the meantime, that's all for this month. See you next time! ❖

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THE SERVICEMAN

The CTV with power rails at half mast, and a VCR that played only one tape a day!

I have some weird and wonderful stories for you this month, folks. From my own bench comes the tale of a Sanyo colour TV which wouldn't display a picture, even though everything seemed OK apart from its power rail voltages measuring about half their normal voltages — and nothing was getting hot! There's also a story from a colleague in Queensland, about a VCR which worked perfectly providing you didn't try playing more than one tape a day...

Perhaps it's just as well that I'm getting close to retiring age. It's becoming harder and harder to solve some of the problems that are presented to me by my customers. Some jobs make no sense and all but defy Ohms Law. The most recent of these turned up a component in apparently perfect condition — but one which simply wouldn't work! It all came about like this...

The set was a Sanyo 34cm, model CPP3001V, fitted with an A1 chassis. I'd first seen it several months ago when the owner complained that it often would not switch on. Also, when the fault was apparent, the TV/video indicator light came on and refused to go off.

At the time, I wasn't able to find any definite fault, although I did see one or two doubtful solder joints. I remade these as a matter of course, and later the set came good. So I don't know if I really did anything worthwhile to it.

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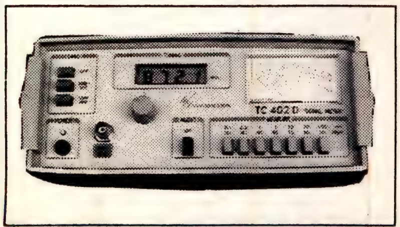

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However, the set played up again recently and when it arrived at the workshop, there was nothing I could do to make it fire up. This time it had really 'crashed', and I was going to have to find the cause before it could go home again.

As before, the TV/video light was on, suggesting that the power supply was delivering power, but that the microprocessor was locked into the video mode. However, this looked less likely when I found that various voltages around the set were all somewhat lower than they should have been.

The 130V rail was down to only 70V, so although the power supply was working, it was delivering just over half of its proper output. My immediate thoughts were on the line output stage and the possibility that it was loading down the supply. But when I looked at the line output pulse with my oscilloscope, it was quite normal — although down in amplitude, as was only to be expected. It certainly didn't look as though it was faulty enough to lower the B+ rail so dramatically.

After that, I decided that the fault must be in the power supply and that I'd have to investigate that part of the set more thoroughly. According to the circuit diagram, it was a very simple self-oscillating chopper supply. There was no feedback control circuit that I could see; the entire regulation depended on a single zener diode in the error amplifier.

However, when I came to examine the circuit board, I found the supply to be somewhat more complicated than expected. Particularly around the chopper transistor base circuit, there were several differences from the arrangement shown in the diagram. For starters, there was a small inductor connected between the base and another part of the circuit associated with the error amplifier. It appeared to bypass the driver transistor completely!

There was no way I could correlate the diagram with the circuit board, so I decided to beg, borrow or steal some other Sanyo diagrams and see if I could find one that agreed more closely with the board in front of me.

I finished up with manuals for models (CPP) 3001, 3002, 3011, 3012, 4012, 6001, 6002, 6011 and 6012. They all use virtually the same chassis, but varied slightly to accommodate different picture tubes. The 30 series were all 37cm models, the 40 series has a 42cm tube, and the 60 sets are all 51cm types.

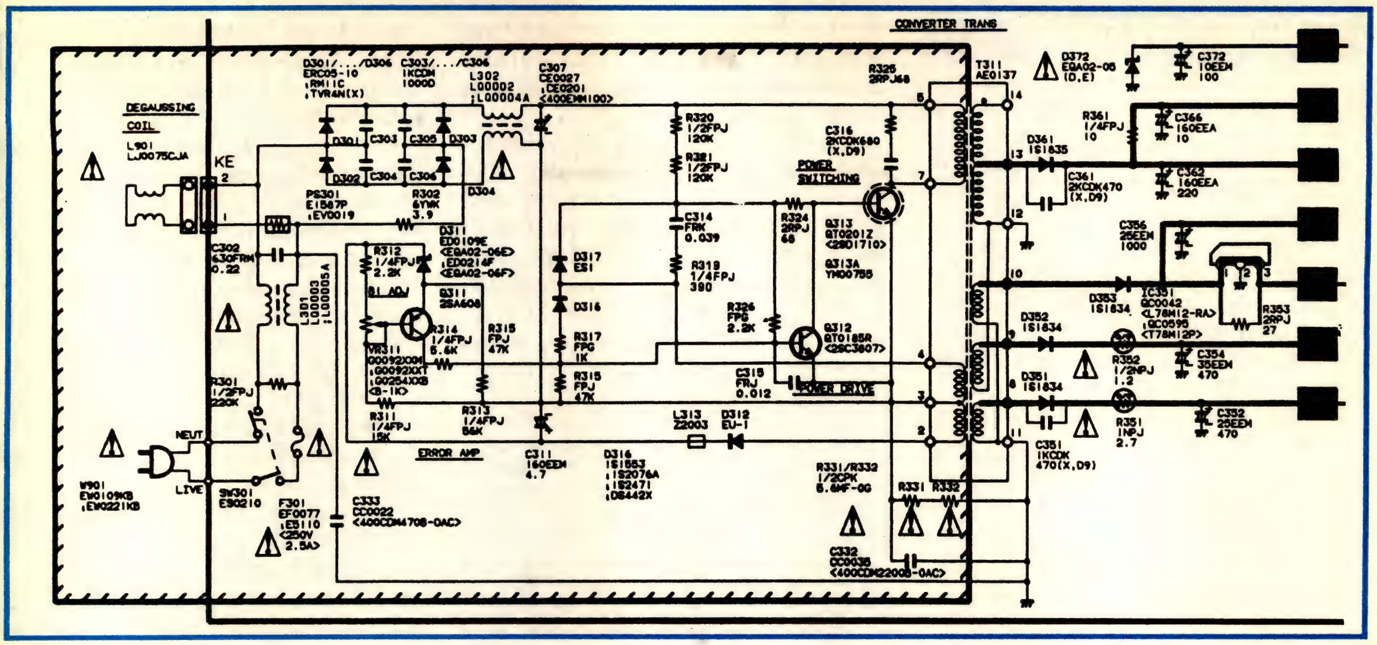
So, with all that information to hand, you'd expect that I should be able to solve my problem. But no! None of these models had a power supply that came close to the one in the set I was trying to fix.

Among that series of models, there were only three basic power supply configurations. That in the 3001 was the simplest, with a zener in the emitter circuit of the error amplifier, a 'set B+' pot in the base circuit, a driver transistor and the self oscillating chopper.

The supply for the model CPP3011 was virtually the same, but included an opto-coupler feedback loop in the error amplifier collector. It had the same emitter zener and B+ pot as the 3001.

The 6002 supply was again similar, but omitted the set B+ pot, instead using the output of the opto-coupler to set the rail voltage. The only other change was that the zener had been moved into the error amp collector circuit.

So the whole series of models used



Here is one version of the switch mode power supply used in a range of Sanyo 34cm colour TVs. This one is the version which should be found in the model CPP 3001V, which forms the subject of this month's first story.

just three basic power supply circuits, none of which corresponded with the one in the set on my bench! Only the 6002 diagram included an inductor in the chopper base circuit, but it was in a different position to the one I was working on...

The only thing in favour of the circuit diagrams, as printed, was that they were accompanied by tables showing voltages on the various transistor elements. Waveform diagrams for the driver and chopper transistors were also presented, although these were of limited value since they omitted the timebase settings. Without this information, it was impossible to know if the chopper was running at or near its correct frequency. As far as I could tell, the chopper transistor was operating properly and the waveforms at its base and collector were very close to those shown on the diagram. Of course, I had no way of telling if the on-off times were correct, (i.e., was the frequency right?) as this would affect the energy input to the converter transformer and thus the rail voltages on the output side.

The on-off times for the chopper transistor are determined by the current through the error amplifier and this is, in part, controlled by the zener diode. I needed to know the zener voltage of this diode, but the circuit diagram wasn't very helpful. You mightn't believe this, but the diode was marked as:

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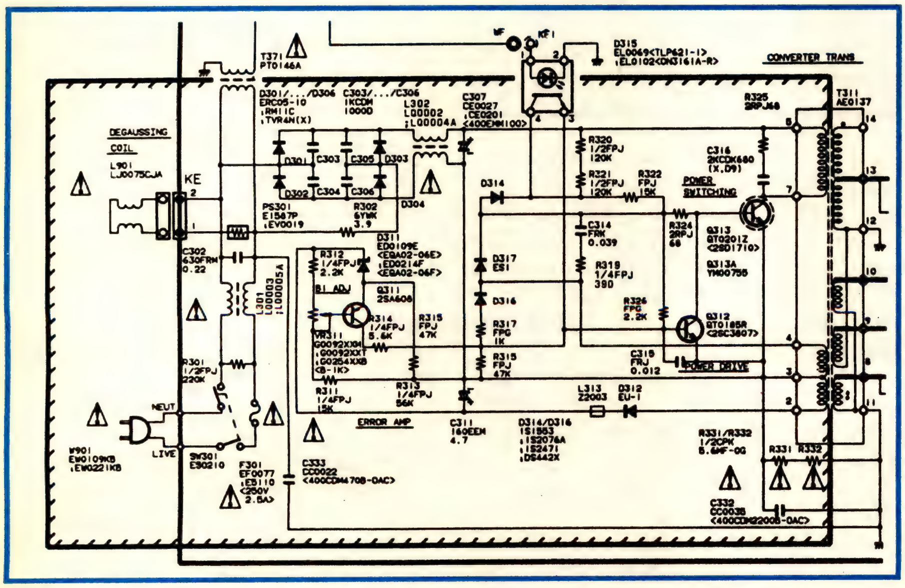

In fact, though, the power supply in the set concerned turned out to be rather closer to this one, which is that for the CPP 3011V...

(It wasn't until I refered to the parts list in the Service Manual that I realised that this ungainly part number was really two part numbers — alternative diodes that could be used in this position. I remain to be convinced that this information overkill is really necessary. All the details were repeated in the parts list anyway!)

The part numbers don't give any clue as to the zener voltage of the diode, although I was prepared to guess that the 06E and 06F part of the numbers refered the value I was seeking. I reckoned that replacing the zener with a six volt equivalent might show me whether my guess was right or wrong. And the answer was YES — I was both right and wrong. The new diode made not the slightest difference to the output. The main B+ rail remained around the 70V mark, and all the other rails were down by the same proportion.

I let the set run for some time while I checked around the power supply and line output stage, looking for some cause of the reduced voltages. I found nothing unusual, but did uncover one surprising fact.

In spite of the fact that something was holding (or loading) the supply down, nothing was getting hot! It was for all the world as though I was dealing with a 'Foldback Regulator'; yet there was no discernable feedback link to the power consuming parts of the set.

The only explanation I can find for the operation of the supply centres around winding 2-3 on the primary side of the chopper transformer. This winding provides a DC rail for the error amplifier via D312 and C311. Excessive load on the secondary side of the transformer could conceivably reduce this DC supply and thus the output of the error amplifier. I know it's only a guess, but it's the best I can come up with!

I would have expected the transformer to get hot if some part of the set was drawing excessive current. I would also expect the chopper transistor to become very hot, but nothing of the kind happened. Even after half an hour, the whole chassis remained only warm.

The whole exercise was becoming very mysterious. It was almost as though Ohms Law had been rescinded — or Murphy had enacted a new one!

After an hour or so I reached the conclusion that I was getting nowhere with voltage measurements or 'scope examinations. What I needed were a few current readings, principally around the line output stage. Unfortunately, there were no easily accessible links that I could open to insert a meter. In the end, I had to cut the track to the input to the line output transformer near pin 8.

But before I put the ammeter into circuit, I switched the set on, just to see what would happen without any load on the supply. Low and behold, the set came good! All the rails were back up to normal and the sound came through loud and clear.

So instead of an ammeter, I connected a dummy load between the 130V rail and ground. The supply ran a 60W lamp quite happily, and only dropped a few volts when I increased the load to 100W. So after all my worries, it seemed that the power supply was the right stuff all the time!

Which left only the line output stage as the likely cause of the trouble. I reconnected the main rail and again looked carefully at the operation of the line output transistor. Its base drive appeared to be normal, and the collector was behaving exactly as would be expected, given the lower amplitude resulting from the lower rail voltage. So what could be going on?

In the end, I decided to replace the transistor, if only because I couldn't think of anything else to do. The transistor was a 2SD1649, one of the newer all-plastic packs. It includes a 40 ohm base-emitter resistor, and a built-in reverse diode. These transistors have quite impressive characteristics and they are comparatively cheap, compared to the old TO-3 packages.

Anyway, fitting the new transistor cured all the trouble, after a fashion. When fired up again, the set produced good sound and correct voltages all round. Out of circuit, the old transistor checked out perfectly — no unexpected leakage and gain normal for the type. Yet in circuit, it just wouldn't work!

No more 'Fault of the Month'...

Those of you who read *EA* regularly will have noticed a segment in the Serviceman pages contributed under the name of TETIA. This was begun 10 years ago at the suggestion of a former editor of this magazine, for the dual purpose of informing readers and promoting TETIA. Over the years the feature has been responsible for introducing dozens of new members to the Institute.

Unfortunately, the feature has now gone into indefinite recess as the direct result of adverse criticism by some TETIA members. The critics have argued that TETIA should not be associated with giving technical information to unqualified persons, and that promotion of the Institute should only be directed at 'qualified' technicians.

I have countered the argument by suggesting that the promotion is of interest more to students and potential Associate members than it is to the dreaded 'backyarder'. Unfortunately, my critics will not be assuaged, so rather than make enemies or bring the Institute into disrepute, I have decided to put the feature into recess.

I appreciate the kind words that have come from members and readers over the years, and hope that the friendships so established will continue. Perhaps one day my critics will have a change of heart and the feature will be able to be restarted. I hope so!

Jim Lawler, Hon Sec.,
TETIA Tasmanian Division.

I can't imagine what could be wrong with the transistor, that it could produce a normal CRO trace, yet do something nasty to the power supply that resulted in lowered output voltages. I even put it back into circuit, to prove that it was faulty. It was!

So I refitted the new transistor and confirmed that all was well again. There was still one problem though — no picture!

I checked that the tube heater was alight and that there was correct voltage and video on the tube cathode. All was in order. Which only left an EHT problem. I used a high voltage probe to measure the EHT but as it happened, I could just as well have used m finger. There wasn't a skerrick of hig voltage. Nor were there any focus c screen voltages.

This could only mean that the lin output transformer was defective. Eithe a winding was open or one of the internal HV diodes had died. All the windings on the primary side of th transformer were normal. Only those o the EHT side were missing.

To shorten a long story, a new transformer put everything to rights and th set came good with a first class picture. It also switches on EVERY time, which, if you remember, was the complaint tha started this saga.

I still don't know what was wrong with the transistor, and the customer has now taken it away as a souvenir so I can't do any research on it. But I'd like to know what could make an otherwise normal transistor act the way it did. Or was it something to do with the transformer? I don't know, but I hope that I'll be fully retired before another one like that comes along.

'One tape a day'

Now, just to show that I'm not the only one who looks for faults in the wrong places, I'll give you a story from a contributor who freely admits to making a similar mistake. We all do it. Even doctors make mistakes, except that theirs don't come back to haunt them!

The story comes from D.T., of Esk in Queensland. Quite apart from any embarrassment caused by his mistaken diagnosis, his story reinforces the suggestion that we should take the customer's description of the fault very seriously indeed. Even if the description makes no sense at the time, it can still provide an important clue as to the cause of the trouble. I'll let D.T. explain...

I normally feel relief, mixed with a little pride, when I have finally traced a difficult fault. But on this occasion, I only feel shame.

Living in a rural area as I do, and with the distances involved, we do not always see the customer face to face. As in this instance, when a friend dropped in a General Electric 6900 VCR with the complaint that it did not work.

Later in the day I tried it out and could not fault it. It did everything a VCR is expected to do, so I put a tape in and ran it for an hour or so, glancing at the picture now and then as I worked on another job. It passed that test, so I left it until I could contact the owner, whose name and phone number I had been given.

That evening, I contacted the lady and asked what the trouble was. "Oh! It only plays one tape a day", she replied. "After that, it will not work again until the next day!" Well, I wondered what THAT could mean in actual fact!

I've heard some funny complaints in my time. Like the one where the customer says "My TV is jumping up and down!" Many times I've been tempted to say "Well sit on it until I can get there!" This time I was looking forward to next morning, when I could test that 'Only one tape a day' VCR.

Next morning, I duly inserted a three-hour tape and set the machine to play while I got on with other work. Three hours later the tape ended, the VCR switched to REW and wound the tape back and switched itself off. So far, so good!

Then I pressed the Play button; there were some noises from inside, a pause, more noises, then it switched itself off without playing. So the customer was right, after all.

I removed the top and bottom covers and the front panel then inserted a tape and pressed play. I watched the loading process very carefully, but everything seemed to be normal. The loading arms took the tape and wrapped it around the head drum, then finished up in their V stops. And the tension arm moved over to its correct position on the left.

It was then that I noticed that the pinch roller had moved only part of the way toward the tape. It did not pin the tape against the capstan spindle; and since the tape did not move, the machine went into the stop mode, the tape unloaded and the system switched off.

I tried it several times, but it was always the same. The machine would not play. So I had found the fault, but not the reason for it.

Since I didn't have a copy of the service manual for this model, I had to wait two days to get one. Once I had a copy of the diagram covering the mechanical functions of the machine, I could see that the pinch roller solenoid was controlled by two drive transistors, Q4 and Q5.

When the solenoid was first activated, both transistors were turned on. But Q5 only stayed on for 330 milliseconds (to pull in the solenoid) then turned off. Q4 remained on, to hold the solenoid in the active position.

Using a meter and CRO, I was able to determine that neither transistor was turning on. The main operations solenoid is driven by Q6 and Q7 and this circuit was found to be working properly. At this point my thinking took a wrong turn.

From past experience I assumed that I had a thermal fault in the IC that drives Q4 and Q5. Spraying the chips and transistors concerned with freezer spray produced no effect. There was a very slight change in the voltage output from IC2 pins 16 and 17; enough to cause a change in the output of the buffer IC and therefore a slight movement of the pinch roller solenoid.

From all of this, I deduced that IC9 was doing its job and that the fault must lie with IC2, a UPD553.164. So next day I got a replacement and lost no time fitting it. I had to play a three- hour tape before I could test the machine; but it was all wasted time, since the fault was still there.

Next day, with the machine in the 'faultless' condition, I made careful notes of the mechanical operation as I repeatedly loaded and unloaded the tape.

Each time the loading arms locked into their V stops and the pinch roller solenoid operated as soon as the tension arm reached the end of its travel. After that I had to run the long tape to get the machine into the fault condition.

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The only obvious difference in the faulty state was that the tension arm moved over more slowly than normal. It had snapped over quite quickly, but now it moved very lazily. I tried giving the arm a bit of assistance with a gentle finger and this time the machine came good.

Looking underneath the deck, I found that the tension arm was not moving far enough to trip the AL (After Loading) switch, which normally caused IC2 to issue the pulses to control the pinch roller. It took several applications of the gentle finger to finally sort out what was happening — but basically, it was a matter of spring tension on the loading arms.

The arms stop moving as soon as they reach the V stops, but the gears that drive them can continue to turn for a short distance, against the tension of springs built into the drive gears. It's this last bit of movement that allows the tension arm to reach and operate the AL switch. In this case, I found that the whole mechanism came to a halt when the loading arms reached their stops. But significantly, the loading motor continued to run for several seconds more. Then I realised what was happening — the loading motor drive belt was slipping!

Fitting a new belt fixed the problem, but I still can't work out why the machine worked properly for just one tape, then failed.

Could it be the warmth inside the machine after three hours of operation? But then a VCR is usually left switched on and remains warm all the time. I wouldn't have thought the change in temperature between stand-by and operate would be significant enough to make the belt slip.

I agree with you, D.T. It's hard to imagine how playing one tape could cause the loading belt to slip. It might have been interesting to experiment with shorter tapes, to see if it had something to do with tape tension which would vary with different lengths of tape.

All I can add is that I have struck some of the strangest faults, all caused by slipping load belts. I've gone so far as to diagnose mode switch problems, only to find later that a simple belt change would have solved all my problems.

Still, 'Just one tape a day!' is the kind of thing to send even the best technician off on wild goose chases! Thanks, D.T.

Resistors falling

Now, we come to a short item from K.V. of Kallangur, in Queensland. (I didn't deliberately choose another Banana Bender, but they just seem to be more prolific at the moment!)

K.V. comments on a statement I made in a story some time ago, that resistors never go low, only high or open. Well, I stand corrected. (Although I still insist that in *my* experience, they don't go low.) But I now bow to K.V's evidence and present his story thus...

'Resistors never go low!' That comment was made earlier in the year in 'The Serviceman'. So far, nobody has taken it up.

I work in industry and have to maintain two ultraviolet oscillographs for fault recording on the high voltage transmission system. These units are started when a fault occurs, and will display on special UV paper the waveforms of feeder voltages and currents just prior to the fault, during the fault and for about three seconds after the fault.

The drive motor runs continuously and the feeder information is being clocked through memory. When a fault occurs, a start-up clutch is energised, and also a high speed clutch if there is a large disturbance. A UV lamp is fired up and a recording is made.

One night, one of our units 'took off' at high speed and gobbled up a full roll of expensive UV paper. The fault was tracked down to the time clock associated with this unit. When the oscillograph runs at high speed, it has to tell the time clock to print out its information at a higher speed. This is done through an opto-isolator.

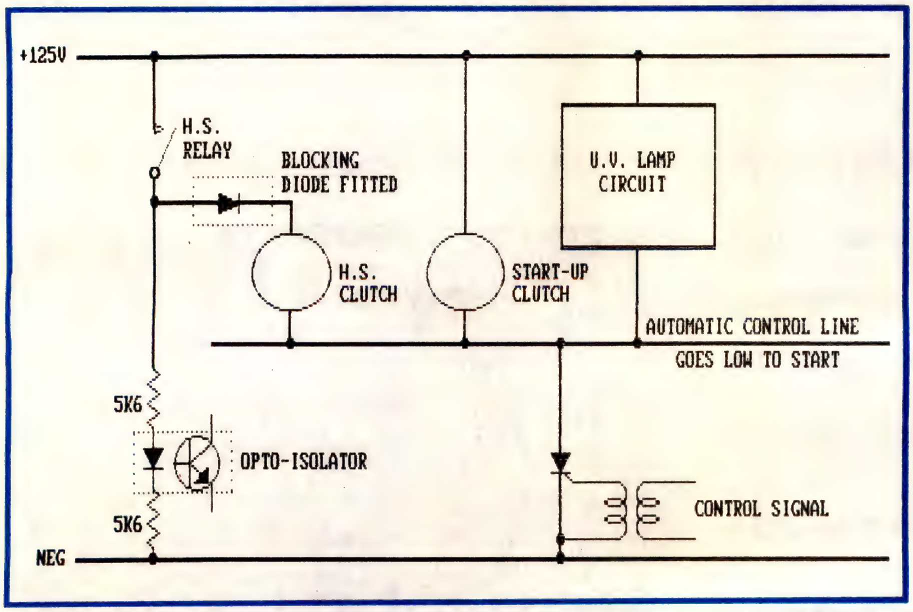
The two 5.6k resistors feeding the opto-isolator had dropped down to nearly 200 ohms each, passing enough current to pull in both clutches.

The second unit was checked and its resistors were also below correct value. So they were replaced. I've managed to find one of these items so I will include it for your perusal.

I have sketched briefly the relevant part of the circuit, showing the path through the two clutches. A blocking diode has been inserted in series with the high speed clutch to prevent this happening again. So, resistors can go low in value! This may have been caused by their having about 50 volts across each continuously. Incidentally, the resistors which failed looked quite OK.

Well, K.V., as mentioned earlier I stand corrected. The resistor enclosed with your letter was clearly marked 5.6k and as I recall, 5%. But it measured 4.6k on three different digital meters and 4.5k on two sensitive analog meters. There can be no argument — that resistor was much lower than it should have been, given its banded tolerance, and gives the lie to my claim that resistors NEVER go low. In future, K.V., I will only claim that 'resistors *rarely* go low!'

That's all for this month. There's a good collection of contributor's items on hand, so next month's column should be one of interest and variety. See you then? ❖



This simplified schematic was sent in by contributor K.V. to illustrate his story about the resistors which went low in value. It's part of the circuit for an ultraviolet oscillograph used in recording high voltage transients.

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Other courses in Electrical, Electronics, Computer Installation and Servicing, Instrumentation and Audio Visual Technology are also available. Courses conducted on site throughout Australia, Asia and the Pacific. Course fees are subject to change and apply to Australian residents only. Course fees shown are for on-campus course delivery at RMIT.

RMIT is now a university incorporating Philip Institute of Technology.

School of Electrotechnology TAFE
City Campus
GPO Box 2476V
Melbourne Vic 3001

RMIT

READER INFO NO. 15

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Amiga conversion for EPROM programmer

As I needed a PROM burner, the programmer published in *EA* in September/October 1993 looked ideal. But I had to adapt it to run on my Amiga computer — with very little extra cost or parts.

As the port structure of the Amiga is different, I have had to use the RS232 port as well. The schematic for the modification is given, and all the instructions to achieve this are listed below. The positions of components refer to Fig.2 on p.74 of the September issue of *EA*. When assembling the PCB leave out:

the IC U6
the link to the left of R16, near C17
the vertical link near R1
the link to the left of U1

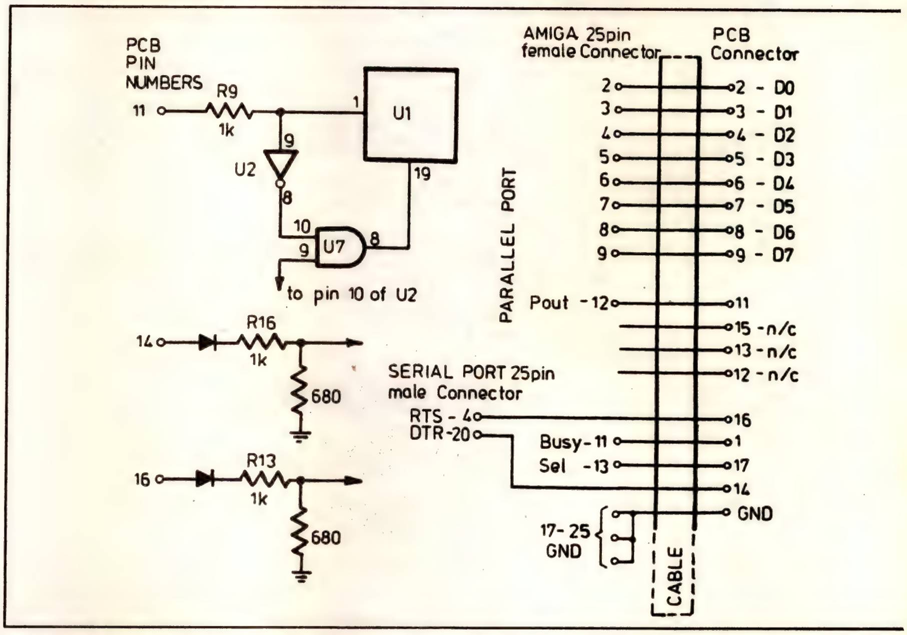
Then cut the tracks between:

pins 9 and 10 of U7
pin 9 of U7 and earth
pin 1 of U1 and pin 19 of U8

Next add wire links from:

the top of R9 to pin 9 of U2
pin 9 of U2 to pin 1 of U1
pin 8 of U2 to pin 10 of U7
pin 8 of U7 to pin 19 of U1

Finally, lift the lower (bottom) ends of R13 and R16 and insert two 1N914s; add two 680 ohm resistors to connect the top ends of R13 and R16 to earth.



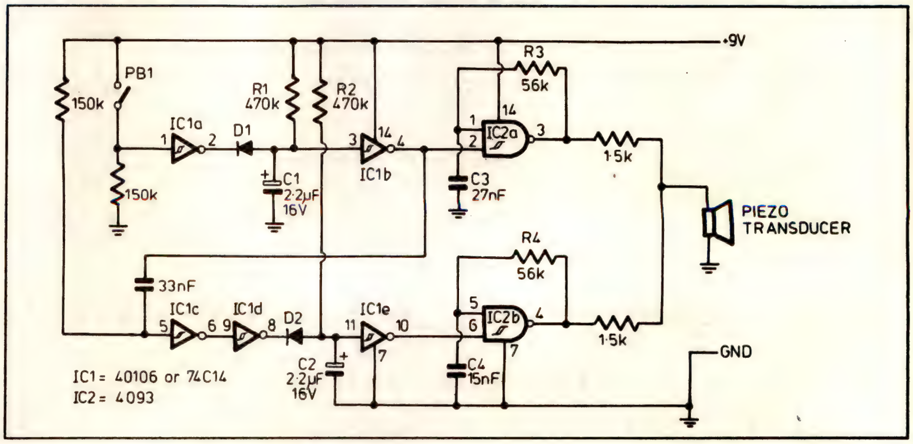
The modification allows IC U1 to pass bi-directional data, to allow data to be read or written by the Amiga data bus. Also the RS232 signal from the serial port needs conditioning to make it safe for the programmer. This is done with the two 1N914s, which pass only the +12V signal, and the two 680 ohm resistors which reduce this signal to 4.8V.

You also need a 255mm length of two conductorwire to join the serial connector to the back of the parallel connector, and to the main cable.

WARNING: when the cable is connected, check with a meter that pins 4 and 20 on the RS232 go to pins 16 and 14, respectively, on the programmer board. These are the *only* inputs that can take this signal without risking damage to the programmer.

J.C. Stacey,
Chatswood, NSW **$45**

Simple 'twin tone' doorbell



Some very elaborate doorbell designs have appeared from time to time in this and other magazines, but it struck me that a relatively simple electronic bell could be made to overcome the problems which I have been having with the 'Ding-dong' type of mechanical bell.

My design is cheap and simple, and runs off a 9V battery pretty indefinitely — removing the need for a power transformer and wires running to the door. Being two-tone, the unit can easily be modified to identify different doors.

Basically, the design consists of two pulse stretchers, each built around two Schmitt trigger inverters (IC1a to IC1d), with the second being triggered by the negative edge transition of the first.

The outputs from the two stretchers gate two Schmitt trigger NAND gates, set up as oscillators, to drive a piezo transducer. The lengths of the pulses are determined by the two RC networks, R1/C1 and R2/C2.

Even in the operating mode, the current drain of the circuit is only about 5mA, and of course the tones can be changed by the adjustment of the 56k resistors (R3 and R4) or their associated capacitors (C3 and C4). Note that an AC driven piezo transducer must be used.

C.C. Wright,
Auckland, NZ **$50**

Tri-mode LED light chaser

The three modes in which this circuit can operate are up, down and auto-reversing, with each of the 16 LEDs in the display lighting up in sequence. The circuit consists of a clock (IC1a and b), a flipflop (IC1c and d), a 4-bit up/down binary counter (IC2) and a 4-bit to 16-line decoder (IC3).

When first powered up, output Q0 (pin 11) of IC3 goes high, which 'resets' the flipflop (if switch S1 is in either position 1 or 2). With Q-bar high, this selects the up-count on pin 10 of IC2. If S1 is in position 3 for start-up, the flipflop is 'set' instead, so the down-count is activated.

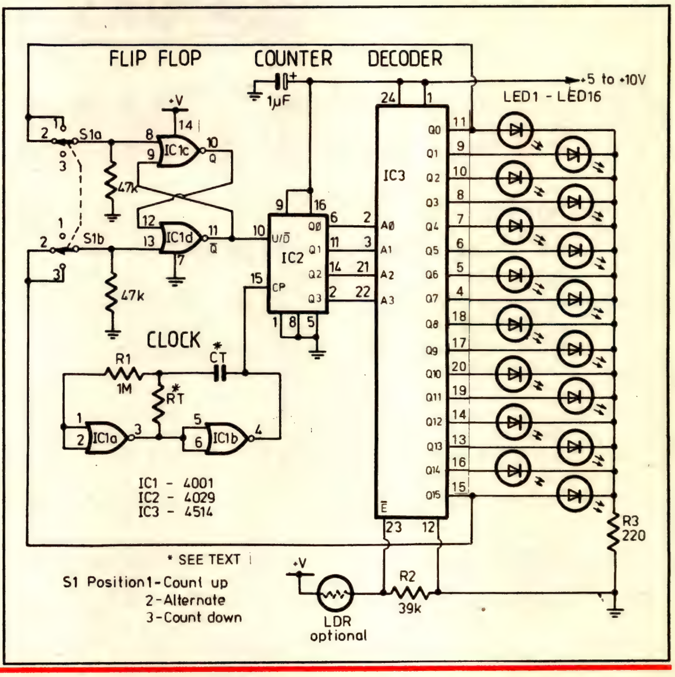
At power-up the clock also starts, with a frequency determined by RT and CT. The value of RT should be around 100k (one tenth of R1); so if CT is 0.33uF, this results in a clock speed of approximately 45Hz. If desired, increasing the value of CT will decrease the clock frequency.

The rising edge of these pulses clocks IC2, and its 4-bit binary code is fed into IC4. This IC decodes the binary value and lights up each of the 16 LEDs in turn, one at a time — Q0 to Q15 for count-up, and Q15 to Q0 for count-down. For switch positions 1 and 3, the LEDs continue to cycle in the chosen direction. However, with S1 in position 2, IC2 starts off counting up; but when output Q15 goes high, this sets the flipflop and hence reverses the counting. It then counts down until Q0 goes high, which again resets IC1a/IC1b. So the display continues to alternate its counting order.

Normally pin 23 of IC3 is held low by the 39k resistor R2 to enable the decoder, but adding the optional LDR will disable the IC in high ambient light conditions. When disabled, all outputs are low. The circuit can run from a single 9V battery for many hours, since only one LED is lit at a time.

Manfred Schmidt,
Edgewater, WA.

$45



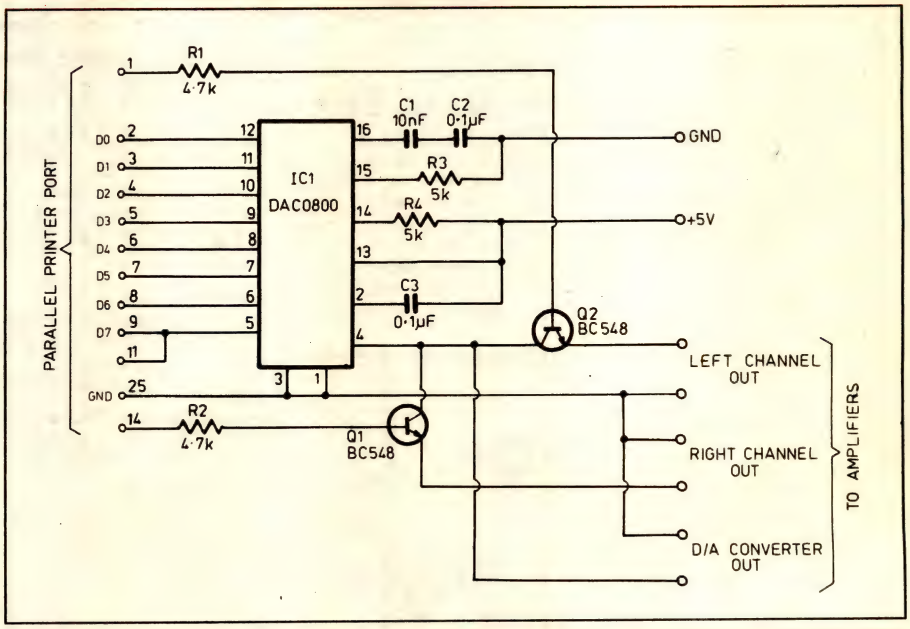
Sound interface

Here's a circuit that allows stereo sound or music to be played from a single parallel port on an IBM PC or compatible, using the program called Modplay (version 2.00 or later). Or the circuit can be used by other programs that need a single D/A converter on the parallel port.

This circuit is based on a British sound card design requiring two ZN428 ICs, which are difficult to obtain outside the UK. Following the demise of two of these ICs, I reworked the design so that only one readily available DAC0800 IC is needed.

The original ZN428 ICs required an enable low pulse on pin 4, and it was this that allows the eight bits of information to be switched from one chip to another and to create the stereo sound. This latching was replaced by transistors on the output pin of the DAC0800, activated by what would be the ZN428 disable pulse from parallel port pins 1 and 14, for the right and left channels respectively. It was this that allowed a single DAC0800 IC to be used.

The Modplay program will automatically detect the presence of this card and work out the port address. However, if the card is to be used as a single D/A converter, then the parallel port address must be determined (LPT1 = $0378, LPT2 = $0278).



Take the address of your parallel port and add $02. So LPT1 = $037A and LPT2 = $027A.

Then go into Debug and type: o 37a,0 (replacing 37a with the port address)

q

Now all 'sound' directed to the parallel port will come via the D/A output only. Note that the D/A output port will also output all music anyway, so it can be used for mono speaker systems or as a D/A converter port without going through the above procedure.

Robert Casey,
Scoresby, Vic.

$45

Amiga conversion for EPROM programmer

Editor's Note: Mr Stacey has provided a program listing of his 'EPROM burner program' for those Amiga owners who use AMOS. He has also included some additional programming information. His program should be easily adapted to BASIC. A photocopy of the three page listing (and programming notes) is available from our Reader Service Division for the usual $7.50 handling charge.

DICK SMITH ELECTRONICS

Invest In These Fascinating Kits!

Lighten Up Your Photos!

Light And Sound Trigger

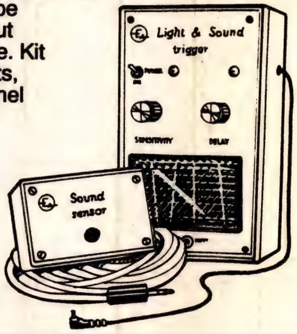
NEW

Now you can get all the special effects from your camera you've dreamed about! This simple circuit lets you enhance your photographic skills in a variety of ways. It fires your flash, allowing you to capture even the quickest events and also provides a supplementary flash to give background or fill-in lighting for your photograph. It can be attached to any camera with an input socket that takes an extension cable. Kit comes complete with all components, hardware, PCB, cases and front panel labels including mini solar panel.

Cat K-3034

$42.95

EA April '94



Universal Pre-Amplifier

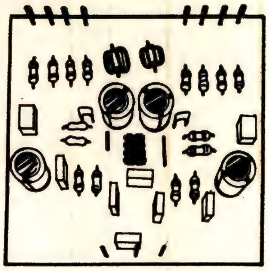
NEW

This low noise pre-amplifier is easy to build and is ideal for use with magnetic cartridges, cassette decks or microphone inputs. If you have distorted sound on your stereo, microphone etc, upgrade your present amplifier's pre-amp by installing this and your reception will be significantly clearer. It uses a single dual op-amp IC (LM-833) with supply rails of 15-0-15 volts and is supplied in shortform with components and PCB only.

Cat K-5402

$16.95

SILICON CHIP April '94



Make Music With Your PC!

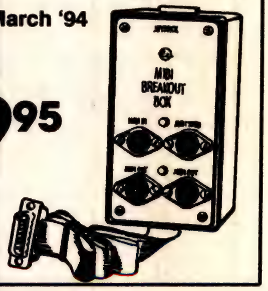
Low-Cost Midi Breakout Box

Do you have a soundcard in your PC? A must for all those interested in making music with their PC, this kit takes the place of those expensive MIDI (Musical Instrument Digital Interface) add-on modules that sound card makers sell you after you've already bought their sound card...and discovered that you can't plug your keyboard direct into the card. It's also a whole lot cheaper than those "off-the-shelf" interfaces and is quite easy to assemble. Includes all components, PCB, hardware, zippy box, cable and pre-punched screened front panel.

Cat K-3604

EA March '94

$39.95



Big Power, Small Price!

50W Amplifier Module

Looking for an easy-to-build audio power amplifier module with a bit more power? Then look no further - this single-chip power module will provide 50W RMS continuous into 8 ohms with extremely low distortion! It features the LM3876 power amplifier IC from National Semiconductor and is useful for a wide variety of audio applications. The kit comes complete with all components, heatsink, PC board, IC and fuses.

Typical Performance (using +/- 37.5VDC Power Supply):

Output Power:
50WContinuous into 8 ohms

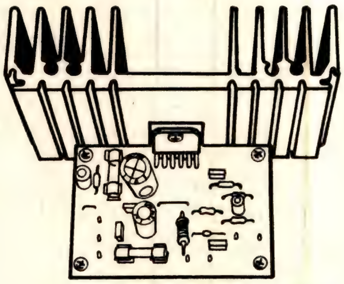
Signal-To-Noise Ratio:
114dB (A-Weighted)
-106dB (20-20KHz)

Distortion:
0.002% @ 50W 1KHz

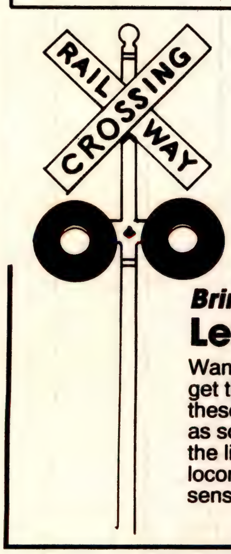
IHF Power Output:
60W @ 1KHz

Cat K-5606

SILICON CHIP March '94



$39.95



Bring Your Model Railway To Life!

Level Crossing Light, Bell And Sensor Kits

Want the realism of a working level crossing on your model railway? But how do you get the lights and bells to trigger as the train approaches? Well, it's easy if you have these two kits - your miniature landscape will become just that little bit more realistic as soon as you install them! Suitable for both single and double-track intersections, the lights and bells are triggered by the sensor unit detecting a magnet hidden in the locomotive. Kits will be supplied in shortform with all components, PCB & necessary sensors.

SILICON CHIP March '94

Level Crossing Light And Bell Kit

Cat K-3028 **$24.95**

Level Crossing Train Detector Kit

Cat K-3026 **$39.95**

PLEASE CONTACT YOUR NEAREST STORE FOR AVAILABILITY AS SOME KITS MAY STILL BE IN PRODUCTION.

You Won't Hear Better Gear Than This!

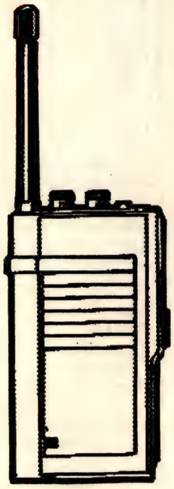
Affordable, Quality Walkie-Talkie

Provides up to 500m range outdoors and no license is required. With belt-clip and earpiece/mic, it's ready for hands-free operation. Requires 9V battery.

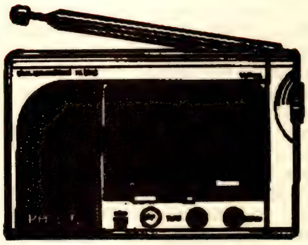
Cat D-1095

$69.95 ea

digitor



Dual-Conversion AE 3405 Receiver



Tune into this pocket-sized 12-band dual conversion receiver that offers both AM and FM reception as well as 9 international SW bands. It features DBB switch for enhanced bass, and a tuning LED indicator for easy operation. A hold function prevents the current station from being accidentally interrupted by making all the other buttons inoperative, and there's both a telescopic aerial for shortwave and an inbuilt aerial for AM and LW reception. It can be either battery (2 x AA) or mains operated with an optional AC adaptor and a stereo headphone socket is supplied for personal listening. Comes complete with protective carry case and shortwave handbook.

Cat D-2856

PHILIPS

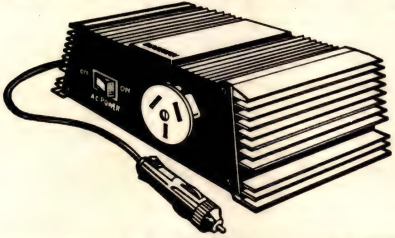
Save $20 **$69.95**

12-240V 200W Inverter

A compact, advanced power system providing 230V AC from a 12V DC source. It will operate most low-powered electrical equipment including smaller televisions and VCRs, personal computers, small kitchen appliances and cam-corder and cellular phone chargers.

DC Input Voltage: 10.7-14.5V (12V nominal)
AC Output Voltage: 230V RMS
Output Frequency: 50Hz
Output Power: 400W (surge), 200W (40 mins), 160W (continuous)
Weight: 1.1Kg

Cat M-5010 **$249**



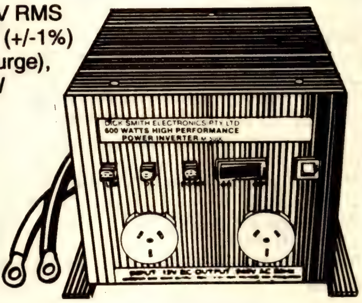
12-240V 600W Inverter

Suitable for heavier applications than the M-5010. With low battery indicator, overload indicator and protection, power indicator, electronic/temperature shutdown, low/high battery shutdown, 2 mains sockets and circuit breaker.

DC Input Voltage: 10.5 - 14.5 (12V nominal)
AC Output Voltage: 240V RMS
Output Frequency: 50Hz (+/-1%)
Output Power: 1500W (surge), 600W (20 minutes), 325W continuous
Minimum load: 7.5W
Weight: 6kg

Cat M-5000

$399



The Latest In Audio Design Technology!

Stereo Pre-Amplifier With Infrared Remote Control

After you build this kit you can really sit back and enjoy the finished product. You won't have to leave your chair once you have the remote in your hand! Use it to adjust volume and balance or to select the program from 6 signal sources (phono, CD, Tuner, VCR, Aux 1 and Aux 2 and tape deck). This convenient remote solves the limitations of conventional models. Because there are no moving parts in the volume control, there's no noise distortion when you alter the volume, additionally, the channel tracking emits no noise, even at the lowest volume level. The front panel of the amplifier features green LEDs to indicate settings made via the remote control as well as the selected program source and dB attentuation level.

The Dick Smith kit is supplied with:

- All components
- Case: Pre-punched and powder coated
- Front Panel: Punched anodised & screened
- Rear case section: Screened
- Remote control unit with anondised, punched and screened front panel
- Microprocessor chip plus IC socket to suit
- Mystery bonus

Cat K-5550

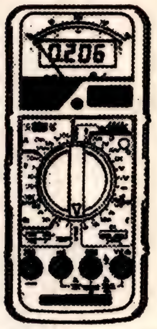
$449

INCLUDING MYSTERY BONUS

Handy Tools For A Job Well Done!

With Analogue Display!

Digital Multimeter



This latest model offers a wide range of features: A sturdy design, it has both 3.5 digit LCD digital and analogue displays for easy, accurate readouts, an easy-to-use rotary function switch, built-in exclusive microprocessor IC circuit and built-in overload protection circuit. Plus, it includes data hold (for analogue display only), high-input impedance for both Analogue and Digital modes and overload protection. Tests capacitance, frequency, transistors, diodes, continuity and temperature.

Ranges:

DCV:	200mV, 2, 20, 200, 1000V
ACV:	200mV, 2, 20, 200, 750V
AC/DC Current:	200uA, 2mA, 20mA, 200mA, 20A
Resistance (ohms):	200, 2K, 20K, 200K, 2000K, 20M
Capacitance:	2nf, 20nf, 200nf, 2uf, 20uf
Frequency:	200Hz, 2kHz, 20kHz
Temperature:	-40° to 250°C

Cat Q-1702

NEW

Save $25

$190

Bonus pH Booklet & pH Buffer Tablets!

Digital pH Meter (pH-Scan 1)

A top-quality, highly accurate meter designed for testing the pH level of water systems such as pools, aquariums, rivers and streams. It indicates whether the solution has a safe pH level or it's acidic or alkaline. Offers push-button calibration for accuracy, hold function, auto-off to conserve your batteries and a large LCD that allows for easy reading.

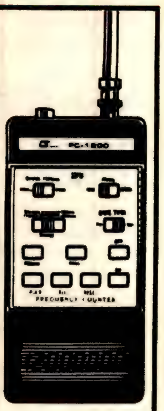
Cat Q-1404

$149.95

BONUS

pH 'Question & Answer' booklet (Q-1406) **and packet of 5 pH-7 Buffer Tablets** (Q-1408).

1.25GHz Handheld Digital Frequency Counter



Ideal for measuring radio frequency transmissions and servicing stereos, videos, computers and cordless phones. This incredibly easy-to-use 10Hz to 1.25GHz frequency counter has an 8-digit LCD display, data hold, relative measurement and data record (min, max & average). There's also selectable resolution, period measurement and more. Comes complete with telescopic antenna and BNC to alligator clip test leads.

Specifications:

Range:		10Hz to 1.25GHz
Impedance:		1M OHM
Accuracy:		+/- (1PPm + 1d)
Range:	Channel A:	500MHz/1250MHz
	Channel B:	10MHz (10Hz to 10MHz)
Typical Sensitivity:		
	Channel A:	10-1000 MHz (3-50mV RMS) =1-1.25GHz (10-150mV RMS)
	Channel B:	10Hz-1MHz (15mV RMS) 1MHZ-5MHz (20mV) 5MHz-10MHz (40MHz)
Max. Voltage:		
	Channel A:	5V P-P
	Channel B:	250V p-p

Cat Q-1322

Save $30

$199

Multifunction Tester

You'll find this tester useful for performing a number of simple test functions such as detecting AC and DC voltage. You can alter its sensitivity according to testing conditions and it has a flashing LED and audible buzzer to warn you if it senses AC voltage above 100 volts.

- AC voltage detector (non contact above 100V)
- DC voltage test (50V max)
- Continuity tester
- Battery tester (1.5V & 3V button cells)

Features:

- Built-in self test circuit
- Sensitivity switch (H-L-O)
- Visual & audio indication

Cat Q-1541

$19.95

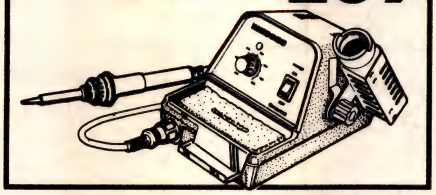
Hako '926' Soldering Station

This high-quality general-purpose soldering iron delivers superb performance! With an accurate manual temperature control, it's rated at 60W 24V AC and has an operating temperature of 200-480°C/392-896°F. The iron comes complete with holder, cleaning sponge, tip and sponge tray.

Cat T-3800

NEW

$259



Ceramic Adjusters/Alignment Tool

You'll find these high quality adjusters perfect for computers, communication instruments, VCR, CD and other electronic devices. They're made from a combination of high-tech-materials with zirconia ceramic blades and anti static handles. Plus, they're non-conductive, non magnetic, non static and long-lasting.

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0.9mm Flat

Cat T-5202
1.3mm Flat

Cat T-5204
1.8mm Flat

Cat T-5206
2mm Flat

Cat T-5208
#0 Phillips

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At this price you can afford to buy the complete set!

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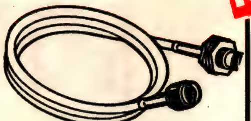

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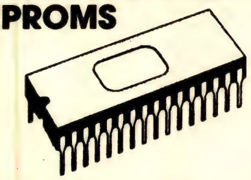

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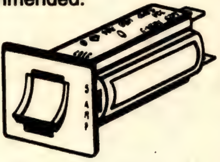

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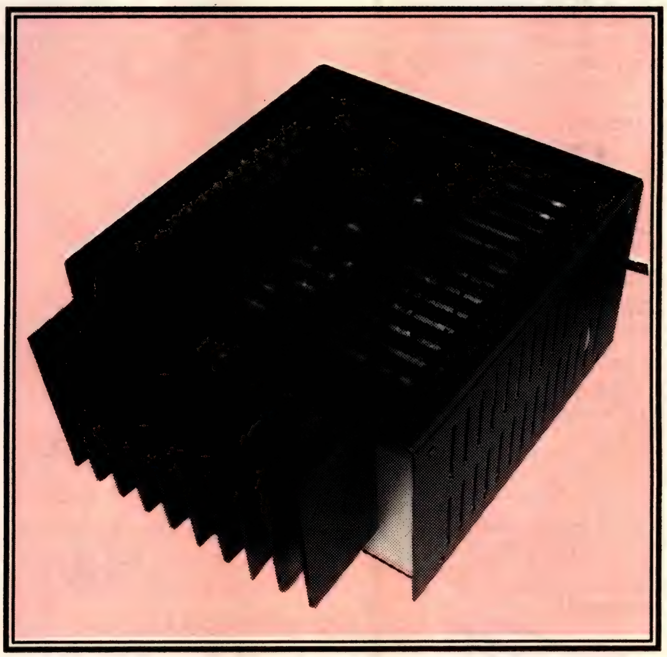
B 1678

Construction Project:

ADD-ON AMPLIFIER FOR SURROUND SOUND

Whether you buy or build a surround sound decoder to enhance an existing stereo system, there's generally something else you still need: additional power amplifier channels, to drive the new 'rear' speakers. Here's a low cost, easy to build design for a two channel add-on amplifier based on the low distortion TDA1514A power amp chips. It can deliver just on 50 watts per channel, which should be more than enough for most people...

by AL YOUNGER



I wanted to call this project something snappy like the 'Nifty Twin Fifty', or even 'Music for Your Rear' — but the Editor decided to give it the much more bland title you see above. At least I tried!

Like many projects, this one came about from a specific need. Having acquired a surround sound decoder to spice up my music listening and bring new life to video viewing, I suddenly discovered that I needed an extra stereo amplifier to run the additional speakers. It had to be compact, because we live in a flat and space is limited; it also had to have a reasonable aesthetic appeal, to keep my wife happy. The design that you see here has solved both of these problems.

I had been thinking about building the amplifier for some time, but needed some inspiration. One day, I was walking on Sydney's 'electronics row' (that's York street, where you find wall to wall electronics stores: Jaycar, Tandy, David Reid and Dick Smith all in one block, with A-One Electronics around the corner), when I spotted a rather pleasant looking heatsink (Fig.1). This looked as if it could be used to form the basis of a suitably neat amp, so I immediately bought it and started work.

I decided to use the heatsink itself as the focal point of the amp, by using it as the front panel. I found it fitted quite neatly on the front of a standard low-cost metal case, as you can see from the photo. The only visible adornment is a small LED used as a pilot lamp, which protrudes discreetly from a small hole drilled carefully in the centre of the heatsink near the top. (By the way, at the time of writing, only Jaycar Electronics had this particular heatsink in stock.)

Discretes vs an IC

If you want to build a stereo power amplifier at low cost nowadays, discrete transistors are not the cheapest approach. The cost of such an amplifier would exceed that of an IC power amplifier, and not necessarily beat the latter's specifications.

Of course if you're independently wealthy and can purchase parts by the bucketful, have extremely high standards and also the time to match parts (especially power transistors), then maybe ICs are not for you. However, even in my old age I still want things done yesterday. So I looked in my 'goodie' box, at my bank account and at a few catalogs, and decided that the most expeditious approach was to use ICs.

The IC I finally decided on is the TDA1514 Alpha (one per channel). This seems to provide the highest output together with the lowest noise and distortion. They're also attractively priced, at only about $20 each.

TDA1514A specs

The TDA1514A is capable of very clean sound indeed at the sort of power output levels needed for surround sound channels — especially in the confined environment of a flat. The typical distortion levels at 32 watts are given in the manufacturer's specs as:

Total harmonic distortion: -90dB
Intermodulation distortion: -86dB

Many of the other analog power IC's were originally designed to drive power devices, such as motors. Used as a speaker driver, the specifications are often grim. The TDA1514A was designed specifically as a 'high performance hifi amplifier', and as a result it has many of the features desired for this kind of application. The features include:

High output power
Low harmonic distortion
Low intermod. distortion
Low offset voltage
Good ripple rejection
Mute/stand-by facilities
Thermal protection
ESD protection
No switch on/off clicks
Very low thermal resistance

SOAR (safe operating area protection) It also requires relatively few external components, these being required only for control of the closed-loop gain, the input impedance, output stage bootstrapping and muting.

One company used the TDA1514A in their amplifier and reported the total harmonic distortion at less than 0.0032% at 32 watts output; I consider that very, very acceptable.

Now I don't have 'calibrated ears', but the amplifier shown here, running full blast, well — it sounds SWELL!

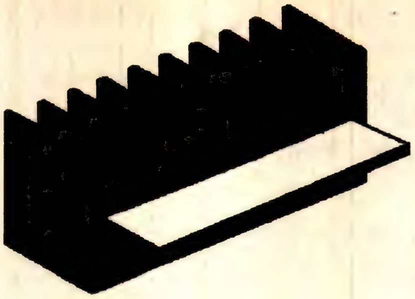


Fig.1: The heatsink used in the author's prototype. A solid casting, it has a 'ledge' to mount the PCB.

The internal configuration of the TDA1514A chip is shown in Fig.2, for those who are like me and want to know 'what's inside'. As you can see it includes both SOAR and thermal shut-off protection circuits, to protect the output stage transistors against both kinds of damage. If the IC shuts down due to overheating it takes about an hour to recover and operate again — assuming you turn off the power, of course.

The purpose of the muting circuitry (lower left in Fig.2) is to prevent a 'thump' from being produced from the speakers when the power is turned on and off. The mute control voltage (Vm) is applied between pins 3 and 4, and is used to trigger a pair of comparators which drive internal switching. By using a simple external R-C time constant, the chip can therefore be muted during turn-on, etc. The switching output of the SOAR/thermal protection circuitry, available on pin 2, can also be linked across to pin 3 to produce muting during overload protection.

The TDA1514A is not indestructible, but ill handle peak output currents of 6.4 amps. The main thing you have to watch is not exceeding the supply voltage rating of 30V, or 60V total single ended.

The IC must be heat-sinked under all conditions, as the quiescent current can be 90mA. It runs a trifle warm with no heatsink!

The output power level capability of the TDA1514A can be adjusted by choosing the correct supply voltage rails, knowing the impedance of your speakers. The correct supply rail voltages can be found from Table 1.

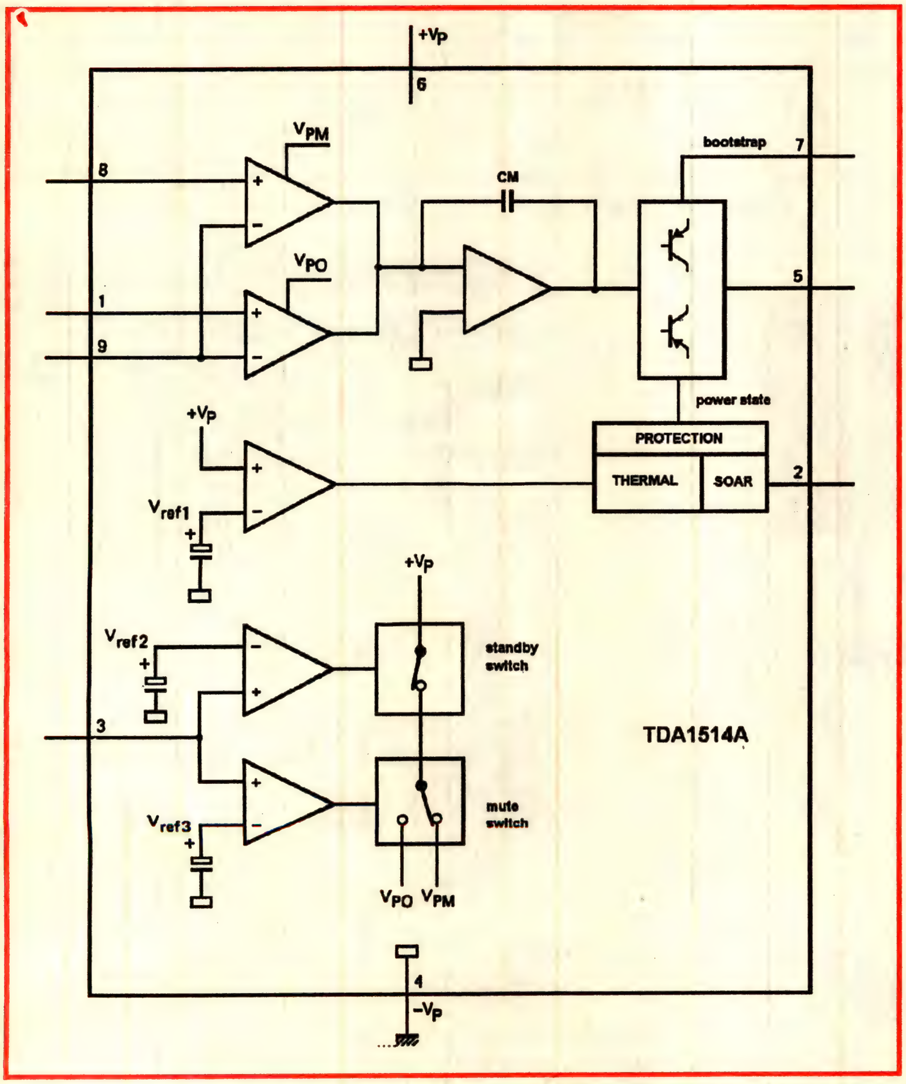


Fig.2: Taken from the Philips data book, this diagram shows a simplified version of the circuitry inside the TDA1514A power amplifier chip. As you can see, it includes both thermal and SOAR overload protection.

Details of the amp

The circuit used for each channel of the add-on amp is shown in the schematic of Fig.3. It should be fairly self explanatory, as much the same configuration using the TDA1514A has been used in other designs. Pot VR1 is a preset, used to set the volume for the surround sound channel concerned. Resistors R6 and R4 are used to set the closed-loop voltage gain (here 22,680/680, or 33), while R7 and C9 form a 'Zobel network' across the output to ensure stability at high frequencies. Resistor R3 and capacitor C3 are used to set the time constant of the muting circuit (here about six seconds).

With the exception of the volume preset pots and the power indicator LED, all of the components for two complete amplifier channels using the circuit of Fig.3 are fitted onto a small PC board, measuring only 50 x 100mm. The single-in-line TDA1514A power packages have their nine connection pins bent over and connected directly to the board, and both they and the board are attached to the 'ledge' of the heatsink using a 111 x 12 x 3mm clamp strip of aluminium, fastened by three 3 x 25mm machine screws, washers and nuts. This makes a very compact and neat assembly — see Fig.4.

Building it

As this project is not likely to be available as a complete kit, all components used will be discussed and information given as to where they can be purchased.

As mentioned earlier, the heatsink forms the front of the amplifier with only one hole drilled for the LED. The

Add-on amplifier for surround sound

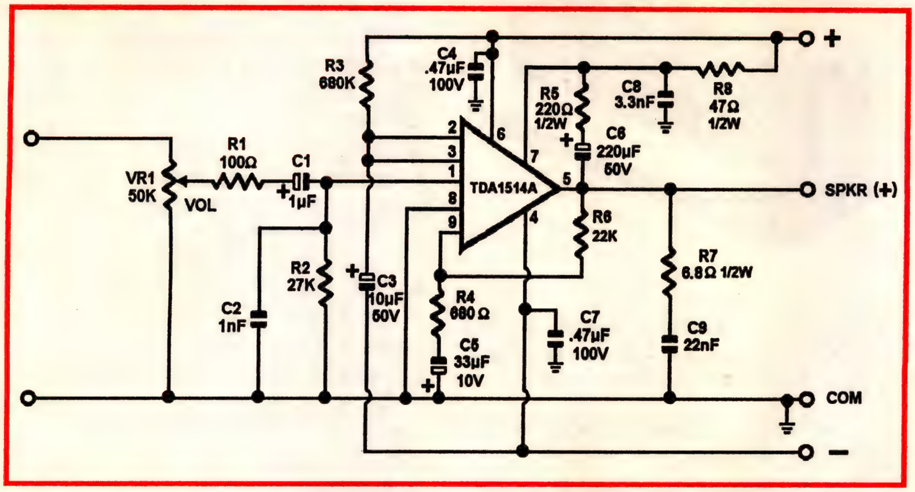


Fig.3: Each channel of the amplifier uses this circuit. Resistors R6 and R4 are used to set the closed-loop voltage gain, while resistor R3 and capacitor C3 provide the time constant for the turn-on muting circuit.

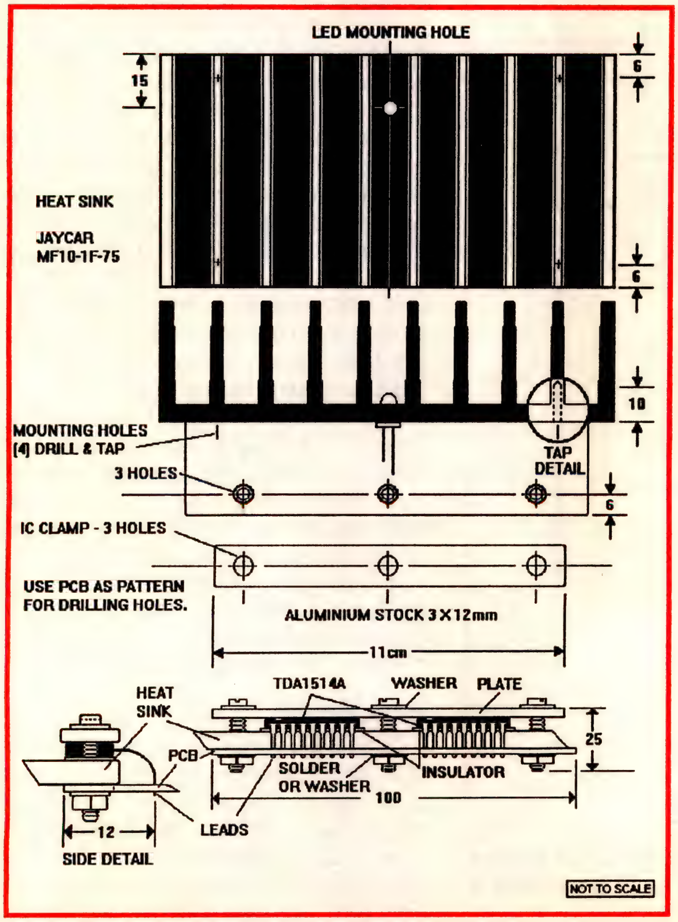
heatsink's thermal resistance is listed as 1.13°C/watt, which is more than sufficient for this application. The Jaycar catalog number for this item is HH-8548, and it's also called the MF10-1F-75.

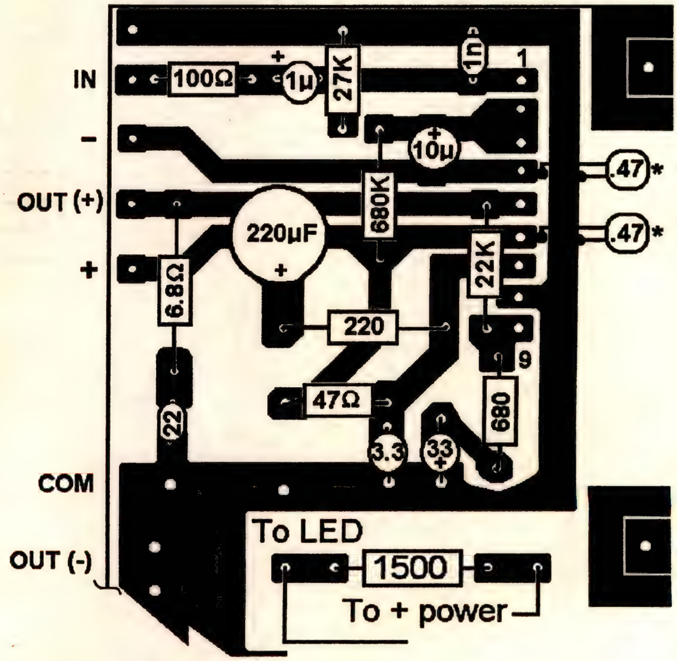
I made no measurements as far as temperature vs wattage, but running the amplifier all day into a pair of Altec-Lansing Stingray speakers, at an above-normal listening level (the cat left the flat), the heatsink was just warm to the touch. There was absolutely no speaker thump switching the amp on or off, which is as it should be using the TDA1514A.

With regard to the position of the heatsink mounting holes, an exact measurement is difficult since the heatsinks are cast and do differ (I purchased two). Centre on a fin and drill a pilot hole 6mm in from the edge and in to a depth of about 10mm, with a 1mm drill bit. Then tap the screw thread, using either a 3mm metric tap, a 1/8" Whitworth or US 4-40 tap. Make sure you have the right size tap-drill bit size, to enlarge the holes first using the 1mm pilot hole as a guide. When tapping, remember that you only need a few threads (three or four, say); if you try to go deeper with the tap you may well break it.

To make a neat job of the LED hole, again drill a 1mm pilot hole first — centred on the gap between the centre pair of fins, and 15mm down from the top edge. Then find the correct drill size for close fit for the LED (around 3mm diameter, but they vary), and drill halfway through from one side, followed by drilling the rest of the hole from the opposite side. This leaves a clean hole, with no burrs.

To drill the mounting holes for the PCB assembly in the ledge of the heatsink, use the PCB itself as a template. Find the centre of the ledge then use the PCB to mark and drill the hole positions. The same technique can be used to mark the positions of the holes in the clamp strip. Again I suggest that you use a





***Solder C4 & C7 (.47) to foil side. Keep capacitor leads short.**

Fig.5 (above): Use this diagram to guide you in wiring up each channel on the amplifier PC board.

Fig.4 (left): Details of the holes which need to be drilled in the heatsink and the clamp strip, and also the way the power chips and PCB are attached to each other and the heatsink.

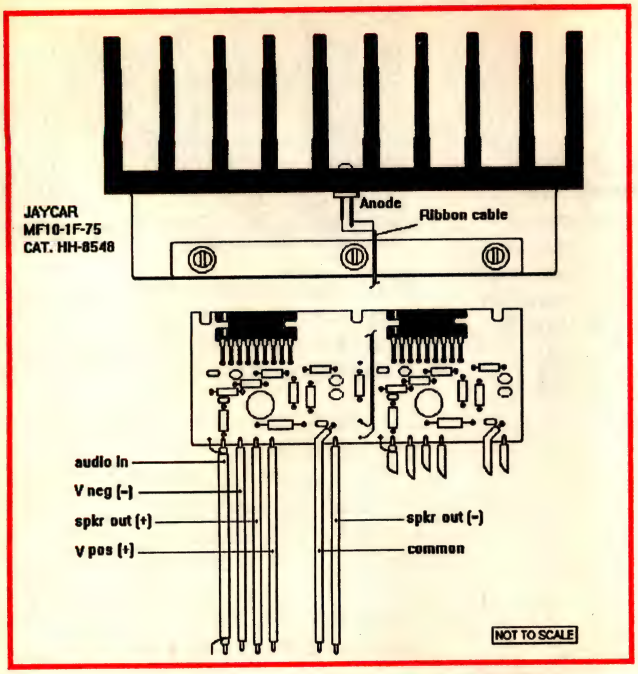


Fig.6: This diagram gives details of the various connections to each channel on the amplifier PCB, as well as showing the lead which connects from the PCB to the LED pilot light.

1mm pilot drill in both cases, then a size to clear your 3mm or 1/8" or 4-40 mounting screws.

The board allows several mounting options. You can drill straight holes, or slot the board (a nibbler works fine). You may also solder the nuts to the board, if desired (but make sure you check the alignment before soldering). (Note that the PCB pattern is proprietary and may not be used commercially without permission. But individuals are free to make the PCB's for their own use.)

After all of the drilling and tapping is complete, draw file the mounting surface until it's flat (so you can mount the PCB/IC assembly properly, for good thermal contact). Then wash and dry the heatsink, and set it aside while you fit all of the components to the PCB.

Fig.5 shows the location and orientation of the components for one channel; the other is identical. As usual insert the smaller components like the resistors and capacitors first, and leave the TDA1514A's until later. Note that supply capacitors C4 and C7 are not added to the board at this stage; they're fitted to the copper side, later on.

I suggest you fit and solder in each group of components as you go, to prevent leaving any unsoldered. Don't forget the wire link for the LED's positive power, and the two wires which run to the LED itself.

Heatsink assembly

To begin the assembly of the PCB and ICs to the heatsink, attach the PCB and IC clamp strip to the heatsink ledge loosely, using the three screws and nuts. Only thread the nuts on for a few turns at this stage — just enough to hold everything together.

Then using a wooden dowel or similar, form the leads of each IC in a downward arc, as shown in the diagram at the lower left of Fig.4. When they look right, fit the ICs under the clamp strip, and check that the leads will mate with the PCB holes — if necessary gently rocking until they fit. Then remove the screws and prepare for the final assembly.

Smear a thin, even layer of thermal conducting grease on the bottom surface of each IC, then place a couple of TO-220 insulators on it (one at each end) and add more grease. Then fit both IC's to the PCB, without soldering, and carefully slide the assembly into place with the PCB below the heatsink ledge, and the IC's above (see Fig.4). Then smear some more thermal grease on the top of the IC's, add the clamp strip again and fit the screws, washers and nuts — only finger tight at this stage.

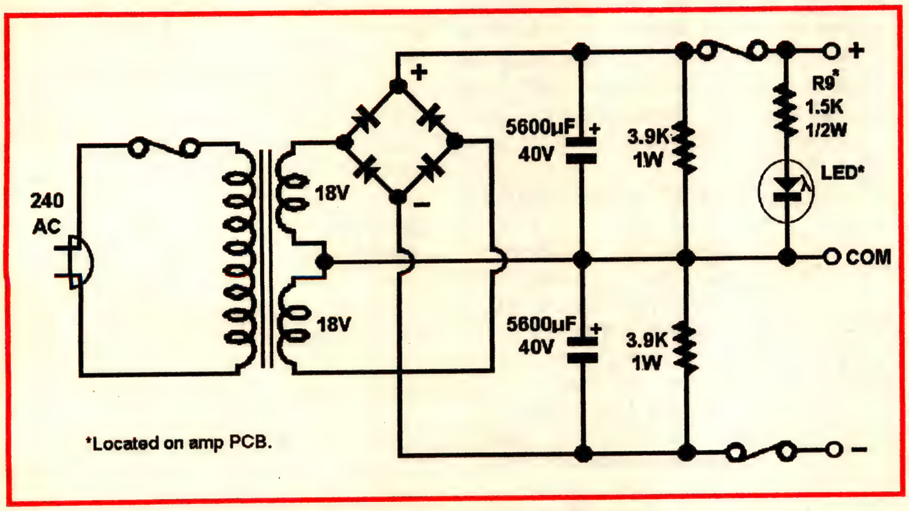
When you're finally satisfied with the physical alignment, tighten the screws firmly, but not too tight. Then after the screws are tightened, you can solder the IC leads.

Now you're ready to solder the two 47nF supply rail bypass capacitors, C4 and C7, on the foil side of the board, keeping their leads as short as possible.

The connections to the complete stereo amp module are shown in Fig.6. For high power applications, solder the power and output leads onto the copper foil side of board, as close to the IC as possible. Use at least $0.75mm^2$ copper or $0.49mm^2$ silver plated copper, multiple strand wire. Keep the power leads as short as possible. For speaker wires use OFC (oxygen free copper) wire if you wish, or *any* dual power cable with a low dielectric constant (capacitance), such as PVC. In fact, you can wire the whole amplifier with this type of wire; it just costs a few cents more. Tin each wire lead before soldering to the PCB, and watch the heat.

Power supply

The maximum supply voltage for the TDA1514A's should not exceed +/-30 volts (60V total). A transformer with two 20 volt secondary windings would give close to 28 volts DC, a reasonably safe figure if you want to get the most output, but such a transformer doesn't seem to be considered a standard model by transformer manufacturers. I found that a transformer from my 'goodie box' having two nominal windings of 18V (at about 2A) gave DC output voltages of +/-



*Located on amp PCB.

Fig.7: The schematic for the author's power supply. The secondary voltage of the transformer can be varied according to the power output required from the amplifier module — but the total DC rail to rail voltage must not exceed 60V.

Add-on amplifier for surround sound

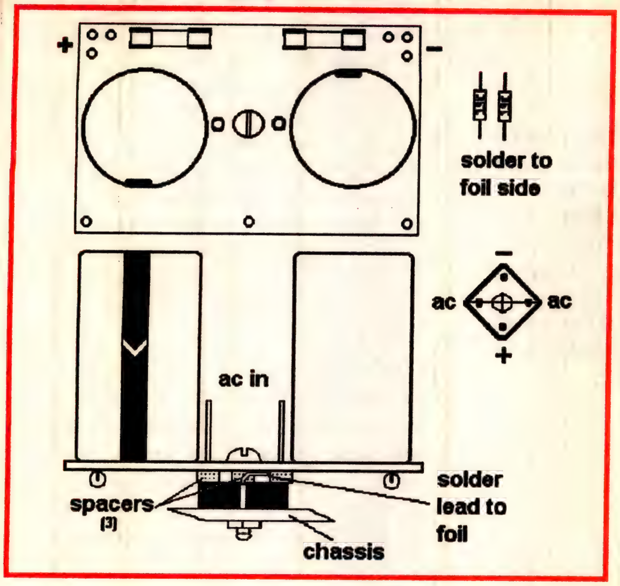


Fig.8: Details of the simple power supply module designed by the author. The filter capacitors, fuses and bleed resistors mount on a small PC board, which is actually supported by the rectifier bridge.

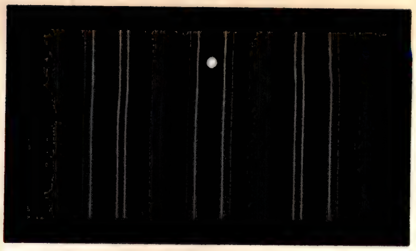


Fig.9: The front of the amplifier looks very simple and elegant — the heatsink itself forms the front panel, with a tiny LED pilot light in the centre.

27.3V, when used in the simple power supply circuit of Fig.7 — with a quiescent current drain of 112mA (56mA each amp channel).

The power supply's operation is quite straightforward; as you can see, it's a simple centre-tapped transformer secondary plus bridge rectifier, to provide plus and minus rails. Don't forget to solder the two 3.9k bleeder resistors on the foil side of the PCB. For the capacitors any value of 5600uF or better is suitable. I have used up to 15,000uF.

I have made several power supplies like this on perforated board, using the bridge rectifier as the stand-off for mounting (Fig.8). To make it easier for you to use this same method, I've designed another small PCB. It's designed to suit a readily available 6-amp bridge and has plenty of room for capacitors, with provision for capacitors of different lead spacings. If the board is too large, just cut it to size.

To achieve the right separation between the bridge and the PCB, I stacked two TO-220 insulation mount rings, cutting the sleeve off one. Any spacer devices will do, as long as they allow some space to bend the DC leads outward without strain.

The AC leads of the bridge are brought straight through the PCB to the top, where you can solder the AC leads from the transformer directly to them. I find this set-up very versatile when experimenting, because to try different plus/minus supply rail voltages, all you need to do is change the transformer secondary leads (or change transformers).

Note that the power supply PCB is designed only for PC-mount electrolytic capacitors, as these are generally cheaper than the chassis mount type.

Testing the amp

Solder the negative, positive and common supply leads in place between the amp and power supply modules. Remove the positive fuse and place an ammeter in line. **At this stage do not apply an input signal, or attach a speaker or load to the amp outputs.** Then turn the power on and look for a current drain of about 112mA. That's the typical current drain, it can be from 60 to 180mA.

I purchased six TDA1514A chips for this project, and each pair pulled 112mA with +/-27.3 volts.

If the current is normal, turn off the power and replace the positive fuse. Then connect the speakers and re-apply the power. Touching the input leads lightly should give a speaker response, and your amp and power supply modules should be ready to mount into a suitable case.

Boxing it up

The case shown in the photo is listed in the Altronics catalog as an instrument box; it measures 180 x 180 x 100mm and is very suitable for housing the amp. In Sydney, it's available from David Reid and A-One Electronics. The front and rear views of the amp as built in this case are shown in Figs.9 and 10.

To build the amp into this case, you'll need an electric drill with bits, a nibbler tool (or file), a measuring rule and a centre punch. I cut a rectangular hole in the front of the case using a nibbler, large enough to slide the amp assembly through without removing the assembled PCB from the heatsink.

The rear panel has four round holes, for the two preset volume control pots, the mains fuseholder and the power cord entry (fitted with a rubber grommet), and two rectangular clearance holes for the twin-RCA input connector and the four-way screw terminal strip for the speaker connections. There are also 3mm holes at each end of the rectangular holes, for the mounting screws (see Fig.10).

To make the finished amp look really professional, I bought some Permantex Sandable primer, 320-grit sandpaper and some black crinkle spray paint. After all the holes were cut, I cleaned the case with soapy water and let it dry. Then I sanded the surface and washed and dried it again, after which I applied a coat of primer before sanding again and finally giving it two coats of the black final coat.

If you decide on the same approach, do yourself a favour and read the instructions on the spray cans. If you follow what the maker says, you'll usually get a good result.

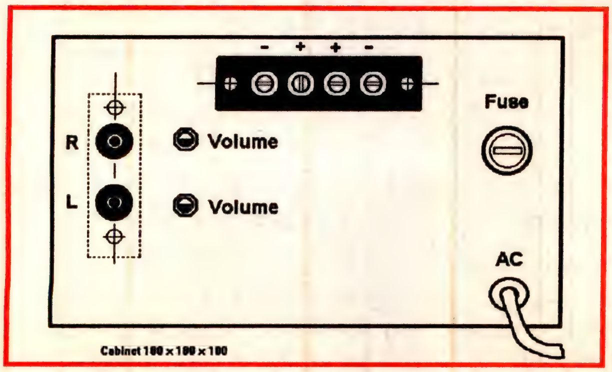


Fig.10: On the rear of the case are the right and left channel input sockets, with their individual preset volume controls, plus the four screw terminals used for the speaker connections. At the right are the AC mains cord entry and fuse.

PARTS LIST

Amplifier

Semiconductors

2 TDA1514A ICs

Resistors

2 2.7k 1/4W (R1: red-violet-red-gold)
2 27k 1/4W (R2: red-violet-orange-gold)
2 680k 1/4W (R3: blue-grey-yellow-gold)
2 680 ohms 1/4W (R4: blue-grey-brown-gold)
2 220 ohms 1/2W (R5: red-red-brown-gold)
2 22k 1/4W (R6: red-red-orange-gold)
2 6.8 ohms 1/2W (R7: blue-grey-gold-gold)
2 47 ohms 1/2W (R8: yellow-violet-black-gold)
1 1.5k 1/4W (R9: brown-green-red-gold)

Capacitors

2 1uF 16VW electrolytic (C1)
2 10uF 25VW electrolytic (C2)
4 0.47uF metallised polyester (C4, C7)
2 33uF 10VW electrolytic (C5)
2 220uF 25VW electroytic (C6)
2 3.3nF (.0033uF) metallised poly (C8)
2 22nF (.022uF) metallised poly (C9)

Power supply

1 Transformer 18V x 2 (3.66 amps)
2 5600uF 40VW electrolytic caps
1 6A bridge rectifier
2 3.9k 1W resistors
4 Fuse clips, PCB mounting
2 Cartridge fuses (to suit power req.)

Miscellaneous

1 Heatsink, Jaycar #HH-8548
1 Instrument box, 180 x 180 x 100mm
2 50k potentiometers, log curve
1 Dual RCA socket, panel mounting
1 Four-way screw terminal strip
Rubber grommet, three-core mains cable, cable clamp, red LED, length of aluminium stock (110 x 12 x 3mm), assorted nuts and bolts.

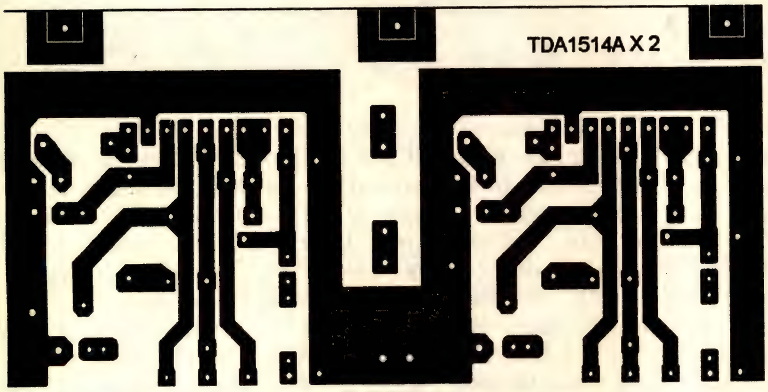
Kit packs available

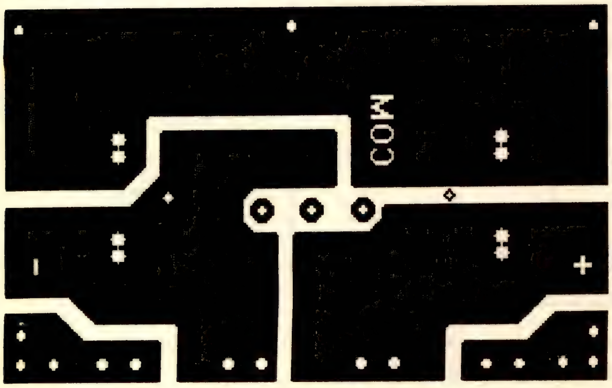
That's about it, apart from letting you know that I have three 'short form' kit packs available for this project — one for the amplifier module, and the other for the power supply module.

The 'Amplifier Power-Head' pack includes the heatsink (drilled, tapped, with all mounting hardware), the amplifier PCB, two of the TDA1514A IC's, a LED (red) and all capacitors and resistors shown in the amplifier parts list. The cost of this pack is $99.00 plus $7.00 postage and handling — a total $106.00.

For those who want to use a different heatsink, and don't mind buying the small components themselves, I have a basic Amplifier pack. This includes just the amplifier PCB and two TDA1514A IC's, and is priced at only $49.00 plus $4.50 postage and handling; a total of $53.50.

Finally, I can also supply the power supply PCB. This is not sold separately; you must order it with either of the above amplifier packs. Order it as the 'PSPCB'. Its cost is only $9.50, including postage and handling. All of these packs are available directly from Al Younger, PO Box 477, Double Bay NSW 2028. ◆





And finally, the PCB patterns for those who wish to etch their own boards. At top is the PCB pattern for the amp and below the pattern for the power supply module. The author has retained commercial copyright but private constructors are free to make their own boards.

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READER INFO NO. 16

Mini Construction Project:

A WEEKLY REMINDER TIMER

Here's a handy little project which will probably appeal to a lot of people — a timer which sounds an alarm and flashes a LED after exactly one week has passed since it was reset. It's easily built, low in cost and fits into a small utility box.

by RON STEINFELD, VK3MHM

The project described here is a weekly timer, designed originally to remind the author to take out the garbage bin every Tuesday night, for collection the next morning. It evolved after many disappointing occasions when the bin was forgotten — those bins are simply not intended to take a fortnight's rubbish!

The resulting circuit sounds an alarm (by flashing a LED and sounding a miniature speaker) every week at a set time. It can have many other uses other than the one it was designed for, by reminding its user to perform a weekly duty at a set time.

After the weekly duty is performed, a button is pressed to reset the alarm. This button is accordingly labelled 'Alarm Reset'. Alternatively, if this button isn't pressed, the alarm will stop automatically about 80 minutes after it has started. The time of the week at which the reminder should start is set by simply pressing a second button (labelled 'Timer Reset') at the desired time of the week.

Circuit description

The circuit uses readily available components and is based around five CMOS ICs. As shown in the block diagram of Fig.1, it consists of a 3.58MHz crystal oscillator and divider chain, driving a pair of flipflops. One flipflop is normally controls the status of the circuit (counting or in alarm mode), while the other generates a 0.5Hz signal used to flash the LED and produce the alarm sound.

With reference to the circuit schematic, the basic timebase is derived from a cheap and readily available 3.579545MHz crystal (as used in American colour TV). IC1 is a 4060 oscillator and 14-bit counter, which divides the crystal frequency by 16384 to give about 218Hz at its Q14 output. This frequency is divided by a further 16384 by IC2, a 4020 counter, to give a period of around 75 seconds (full cycle) at Q14 (pin 3). IC3 is another 4020, which is 'programmed' to divide down by a factor of 8065, using IC4a and b — configured as a seven-input AND gate.

When IC3's count finally reaches 8065, one week after the circuit has been reset, all of its ANDed outputs (Q1 and Q8 - 13) will go high, making the output at pin 1 of IC4 go high. This sets flip-

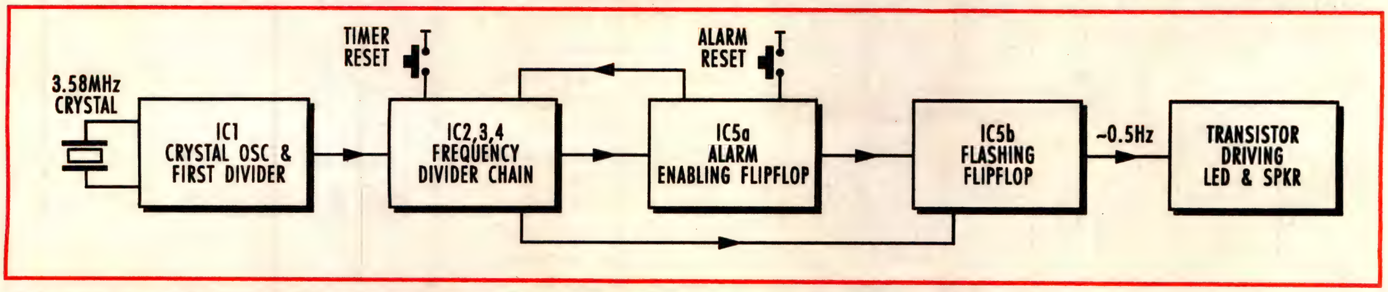
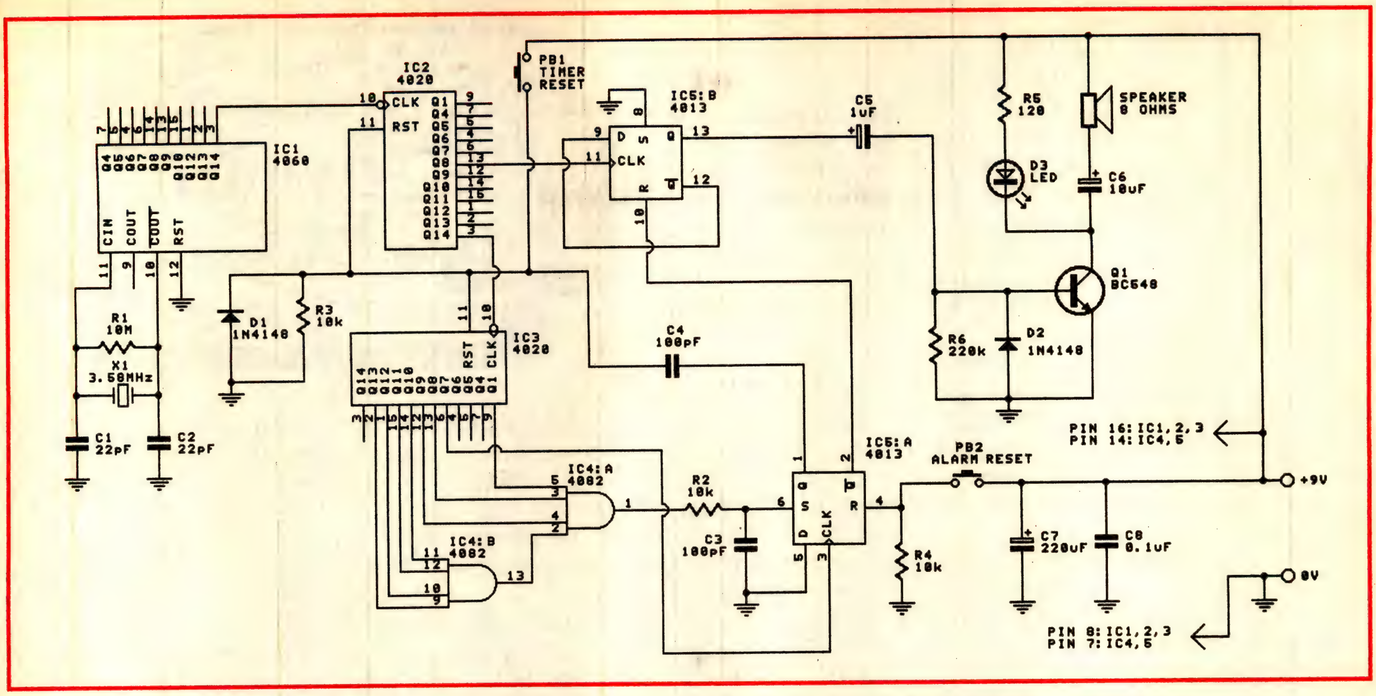

TIMER RESET
ALARM RESET
3.58MHz CRYSTAL
IC1 CRYSTAL OSC & FIRST DIVIDER
IC2,3,4 FREQUENCY DIVIDER CHAIN
IC5a ALARM ENABLING FLIPFLOP
IC5b FLASHING FLIPFLOP
~0.5Hz
TRANSISTOR DRIVING LED & SPKR

Fig.1: A simplified block diagram of the timer, to help you in understanding its operation.



The full schematic for the timer, which as you can see uses only five low cost ICs and a single transistor.

flop IC5a (4013 D-type), after a delay of about 1us caused by R2 and C3. This delay ensures that very brief logic '1's at the output of the AND gates (pin 1), caused by counting 'glitches', will not set the flipflop.

The setting of IC5a pulls its Q output (pin 1) high, which gives a 1us-wide reset pulse (set by C4 and R3) to IC2 and IC3, to start a new week of counting. This resetting can also be done manually (to set the required time of the week at which the reminder should start the alarm), by pressing PB1. The setting of IC5a also pulls its Q-bar output (pin 2) low, and this releases the reset from IC5b (pin 10). This second flipflop is clocked by the Q8 output of IC2 (pin 13) at about 1Hz, so its Q output (pin 13) gives a two-seconds-long cycle to pulse transistor Q1, which controls the alarm (LED and speaker).

The duty cycle of the transistor is reduced to about 10% by the differentiating action of C5 and R6, with diode D2 as a clamp.

The LED is driven by a large current pulse of about 60mA peak, set by resistor R5, to achieve high visibility (the eye is sensitive to short, but strong light pulses). The speaker is connected in parallel with the LED and its resistor and in series with a 10uF electrolytic capacitor. The latter only allows current to flow into the speaker for a very short time, to achieve a strong audible 'click'.

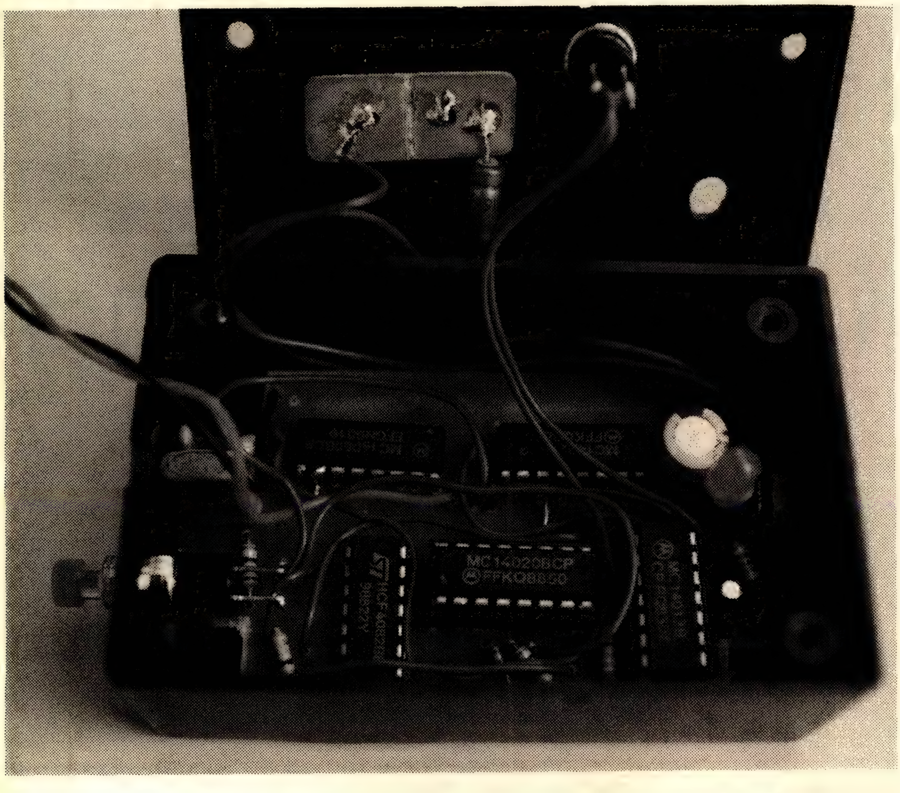
About 80 minutes after the setting of IC5a (the activation of the alarm), Q7 of IC3 (pin 6) goes high. This is used to clock IC5a, bringing its Q-bar output high and in turn resetting IC5b, disabling the alarm. If different alarm times are desired, other outputs of IC3 may be used (the times grow by a factor of two for each respective Q output).

The alarm can also be disabled manually by pressing the 'Alarm Reset' button (PB2).

Construction

The PCB shown, was designed to fit into the smallest size zippy box. Note that the corners of the board must be cut as shown to allow the PCB to fit inside the box.

Before mounting any parts on the PCB, check the copper pattern carefully for shorts and other defects. It is likely that any faults which this unit develops, will be due to shorted tracks.



An inside view of the author's prototype, showing where everything goes.

Reminder Timer

If all is well, wire the links first as shown in the diagram. Then follow with the resistors, diodes and other components. Mount the LED (D3) so that its base is approximately 15mm above the PCB. Take care with the polarised components (especially the ICs) to orientate them correctly, and try not to touch the pins of the ICs since they may be damaged by static discharges.

All components are mounted on the board with the exception of the two switches, the speaker and its series capacitor (C6). Note also that the 0.1uF ceramic capacitor C8 is fitted on the track side of the PCB under the 220uF cap (C7).

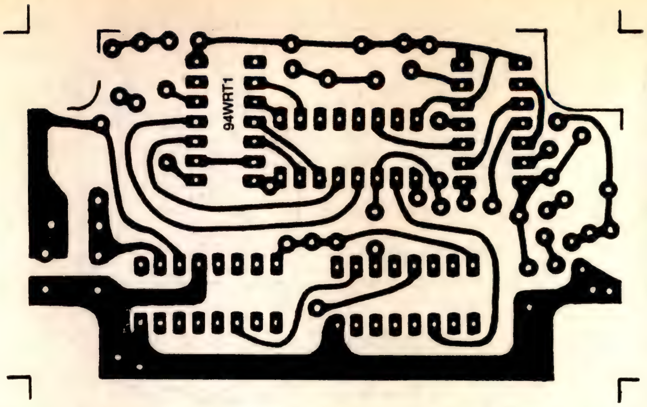
The holes can then be drilled in the box. The exact positions of the pushbuttons and speaker are not critical. However, the hole for the LED must be correctly positioned so that the LED will protrude through it when the lid is closed. No mechanical support for the PCB is required, since it is quite a tight fit inside the box.

Testing & using it

There is a problem in checking that the unit works, because you will have to wait a week to see any results. However, you can do a quick check to verify that most of the circuitry is operating. Temporarily, disconnect pin 6 of IC5a from the junction of R2 and C3, and connect it to the +9V rail. The LED should start flashing for a short period (about 300ms) every 2.3 seconds, and the speaker should sound a strong 'click' every time the LED flashes on. If the unit passes this test, then it is most likely that the circuit is fully operational.

Finally, to set up the unit, press the 'Timer Reset' button the next time you perform your weekly duty. The alarm should then sound at the same time next week.

Here is the actual size artwork for the timer PCB, for those who wish to etch their own.



Possible improvements

The quiescent current drawn by the unit as it stands is in the order of about 1.5mA. This means that the unit should be powered from a dedicated 9V plugpack, since one of the usual 216-type 9V batteries would be flattened fairly quickly at this current.

However, if the voltage is reduced to 3V, the current consumption of the circuit drops to around 250uA. This would allow between six and 12 months of operation using two AA batteries in series.

There is a problem with this approach, since the 4060 (IC1) is not guaranteed to operate at 3.58MHz when powered by only 3V. The prototype did operate quite happily at this voltage, but if guaranteed operation is required, then IC1 can be replaced with the rather harder to obtain 74HC4060. This IC can easily handle the above conditions.

If battery operation is decided upon, alkaline batteries are strongly recommended to ensure a reasonable operating lifetime. Also note that if alarm performance is not to be compromised, resistor R5 should be changed to 22 ohms to account for the drop in supply voltage from 9V to 3V. ◆

PARTS LIST

Resistors

All 0.25W, 5%:

R1	10M
R2,3,4	10k
R5	120 ohms
R6	220k

Capacitors

C1,2	22pF ceramic
C3,4	100pF ceramic
C5	1uF electrolytic
C6	10uF axial electro
C7	220uF electrolytic
C8	0.1uF ceramic

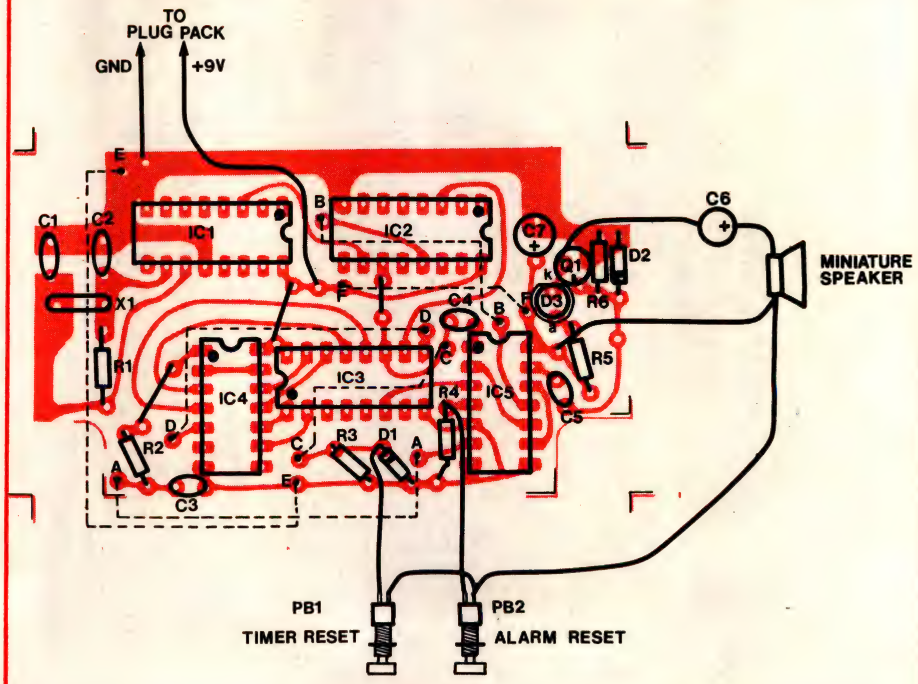
Semiconductors

D1,2	1N4148 diodes
D3	5mm red LED
Q1	BC548 NPN transistor
IC1	4060 counter/oscillator
IC2,3	4020 14-bit counters
IC4	4082 dual 4-input AND gate
IC5	4013 dual D-flipflop

Miscellaneous

1	Miniature speaker, 8 ohms 0.1W
2	Normally open push buttons
1	3.579545MHz crystal
1	Small jiffy box size, 83 x 54 x 28mm
1	PC board, 77 x 46mm
5	IC sockets (if required)

Hookup wire, solder, batteries or plug pack supply, etc.



The overlay diagram for the timer. Note that capacitor C8 is fitted on the copper side of the board, directly underneath C7.

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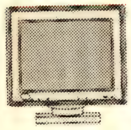

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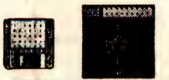

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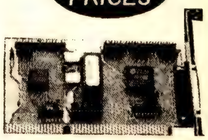

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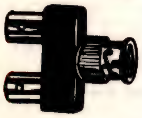

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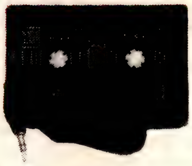

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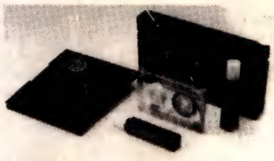


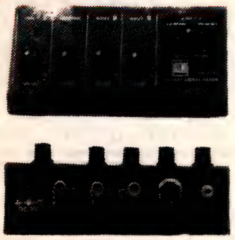
- VHS video head cleaner
- Automatic cassette deck cleaner
- Chamois type compact disk cleaning kit.
- Cleaning fluid supplied with cleaning kit

A10015.......................$29.95

AUDIO VIDEO MIXERS

FOUR CHANNEL MINI AUDIO MIXER

NEW



This mixer is an inexpensive way of combining several audio tracks from microphones, tapes or cassette decks to your VCR, video or simply another cassette or tape deck. Providing your VCR or camera has dubbing facilities it can even add narration and background music to your existing video footage.

- Master and independent channel controls.
- Battery operated or battery eliminator
- Cable included in pack.
- Two auxiliary inputs.
- Two microphone inputs.
- Output to auxiliary input on amplifier or VCR.
- Input sensitivity: 100-250mV
- Output impedance: 600 ohm.
- Output level: 90mV
- Battery Type: 9VDC - 006P
- Optional External Power: 9VDC - 100mA

A12027...................$69.95

STEREO AUDIO MIXING CONSOLE

NEW

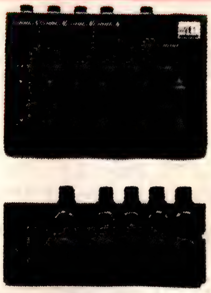
Here's a system to allow you to easily add additional soundtracks and audio effects to your existing video tapes. Used in conjunction with your VCR and its dubbing facilities external audio tracks from compact discs, records, cassette or tapes or simply narration via a microphone can be inserted to most video formats including VHS, VHS-C etc. The Mix 100 can also be used as a stand alone audio mixer for combining audio tracks on your Hi-Fi system cassette deck.

- Master and independent channel volume controls
- Four auxiliary inputs
- two microphone inputs
- Two turntable inputs
- Output to auxiliary audio input on amp or VCR.
- Mono / Stereo switch.
- Battery operated or battery eliminator ready.
- Input sensitivity: 100mV-1V
- Output Impedance: 600 ohm
- Output level: 775mV.
- Battery Type: 9V DC - 006P
- Optional External Power: 9VDC - 300mA regulated.

A12028....................$74.95

MICROPHONE MIXER

NEW



4 STEREO OR MONO CHANNEL MIC MIXER

8 mono or 4 stereo channel inputs. Dual left & right output. Individual channel volume controls and master volume control.

- LED power indicator.
- 6.35mm in and out sockets
- Battery powered with optional DC inlet socket
- Supplied with 2 output leads.

SPECS:

- Input: 8 x 600 ohm impedance
- Imput sensitivity: 1mV
- Output level: 90mV @ 5mV input

THD: 0,01%
S/N Ratio: 55dB + /-2dB

- Freq Resp: 15 to 15kHz
- Power: 9VDC or battery eliminator

A12026..................$159.95

IBM COMPATIBLE / ATARI JOYSTICKS

NEW

JS200

IBM PC AT/XT compatible joystick

- Standard 15 pin "D" plug.
- Auto fire ready
- Fully proportional control
- "X" & "Y" axis trim controls.
- Suction cap feet.
- Bio grip for maximum control
- Turbo fire capability
- 2 positive response fire buttons

C14222.......................$39.95

NEW

JS300

Atari / Sega compatible joystick.

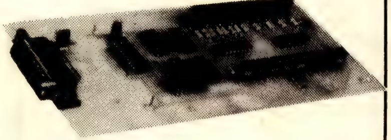
- Standard 9 pin "D" plug.
- Auto fire ready
- Full proportional control
- "X" & "Y" Axis trim controls
- Suction cup feet.
- Bio grip for maximum control
- Turbo fire capability
- 2 positive response fire buttons

C14224....................$24.95

NEW KITS

LOW COST MIDI BREAK-OUT BOX KIT

Have you been looking everywhere for a special MIDI adaptor cable or "breakout box" so you can use your MIDI port on your sound card with external music keyboards or synthesizers? Well stop looking! This low cost MIDI breakout box does just that. And for a fraction of the cost of a commercial unit. We supply the PCB and electronic components only - no hardware allowing it to be built into existing equipment. E.A FEB. '94.
PLEASE PHONE FOR PRICE & AVAILABILITY.



CONTROL STEPPER MOTORS WITH YOUR PC

Want to know how stepper motors work and how you might be able to use your PC to control them? Then this is the kit you should get! If you own a computer you probably know that you have a little stepper motor in your floppy or older style hard drive. This great little kit will plug directly into any standard printer port
giving it the ability to control two stepper motors. However it can be cascaded to control up to eight stepper motors.

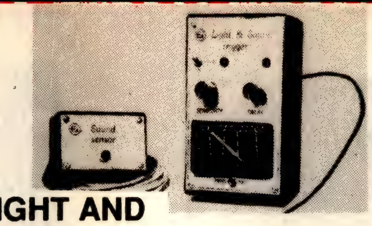
- Requires external 12 Volt power supply.

Ref: Silicon Chip Jan. '94.

K10480..................................$65.95

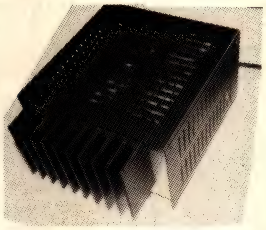
EGO (EXHAUST GAS OXYGEN) TESTER KIT

This kit is sure to save you money. It's an EGO sensor. Designed to monitor your engines exhaust gas and indicate to the EFI computer whether your engine is running lean, balanced or rich according to the air/fuel mixture. In other words it tells you if your car is running in tune. Then it's a simple matter of adjusting the EFI computer or your carburettor .PCB, case, clips and components supplied. E.A FEB '94
PLEASE PHONE FOR PRICE & AVAILABILITY



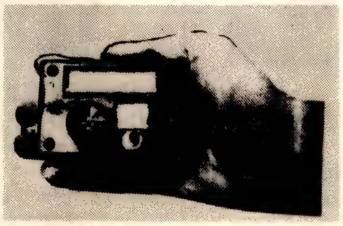
LIGHT AND SOUND TRIGGER

Always wanted to create special effects with your camera by capturing that exact moment when something occurs? For example, a light bulb breaking, a drop of water splashing into a puddle or bowl or a tennis or squash ball impacting with a wall or racquet! Well with this light and sound trigger you can . This kit activates the camera flash from a sound source. You can also trigger a second flash from the main one or even delay the flash by a controlled time.
The kit includes the following: 2 PC boards, 2 boxes, audio transformer, solar panel, mic insert, 3.5 socket and all specified components.
Extension sync lead flash is not supplied. These are available from most camera stores.
REF. ELECTRONICS AUSTRALIA APRIL '94
PLEASE PHONE FOR PRICE & AVAILABILITY.



ADD-ON AMPLIFIER FOR SURROUND SOUND

Here's a low cost, easy to build design for a two channel add-on amplifier based on the low distortion TDA1514A power amp chip to drive your rear speakers on your surround sound decoder. This kit is ideal for people who haven't much room to spare in their home and want something that is reasonably aesthetic appealing. And it can deliver just on 50 watts per channel! REF. EA APRIL '94
PLEASE PHONE FOR PRICE & AVAILABILITY.



A WEEKLY REMINDER TIMER

A timer to remind me to put out the rubbish!!!
:"What a Load of Garbage"
But that's what you'll get if you do forget bin night! However, with this handy little kit you'll never forget again. A timer which sounds an alarm and flashes a LED exactly after one week has passed since it was reset. It will remind you to do anything that has to be done once every week at a specific time. After the weekly duty is performed a button is pressed to reset the alarm, if the button isn't pressed the button will automatically stop after about 80 minutes. It's easily built, low in cost, and fits into a small utility box. E.A APRIL '94.
PLEASE PHONE FOR PRICE & AVAILABILITY.

MORE NEW COMPONENTS

MINI DIN CHASSIS SOCKET

MINI DIN chassis socket, solder type, polarised, metal pins and housing.

MINI DIN Chassis socket (Solder)
P10325 10mm dia. mount holes 30mm apart. **$2.20**
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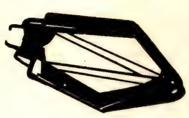
PLCC EXTRACTOR

NEW



PLCC type
T12354...............................$9.95

CABLE JOINERS / SPLICERS

NEW

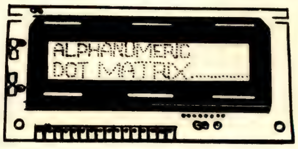
The simple way to join or splice cables.
No solder, no mess!

- Two in - One out.

H11487.......................................$3.95

ALPHANUMERIC DOT MATRIX LCD MODULE

NEW

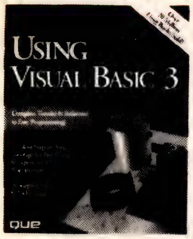


This little Alphanumeric Dot Matrix LCD module will make your kits and projects more interesting and professional looking. It has 96 inbuilt ASCII characters and 92 special characters. The two line screen has the ability to display 16 characters. It even has it's own built in memory which holds the current message on the display.

SPECIFICATIONS:
Module Size: 84 x 44 x 9.7mm
Display Size: 61 x 15.8mm
Character Size: 2.96 x 5.66mm
Contrast Ratio: 10
Number of Characters: 16 characters by 2 lines
Viewing angle : Between 50 and 30
Longitudinal 60 - 120 lateral
Supply Voltage: 5V DC
Power Supply current : 1mA Typical

S13064...$34.95

NEW BOOKS



USING VISUAL BASIC 3

Access visual basic easily effortlessly with Que's Using Visual Basic 3!

Enhance your programming skills, almost immediately with this guides simple reference and tutorial approach. The focus on great results. As you discover how to navigate the Visual Basic 3 environment, manage OLE, and develop expert programming techniques you learn how to create your own software.

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over 1335 pages.

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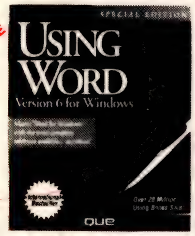

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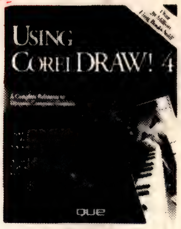
AN ESSENTIAL REFERENCE



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- Award winning full colour sample instructions.
- Comprehensive tips and techniques integrated with the newest trends in graphic design.
- Animation advice & image manipulation guidelines guarantee success.
- 696 pages

B21404..........................$59.95

A COMPLETE & INSTANT GUIDE TO LOTUS IMPROV

LOTUS IMPROV FOR WINDOWS QUICK REFERENCE

This compact guide is an instant reference for the most often used commands, features and options of Lotus innovative, new spreadsheet. Organized by task, this handy reference guides you through all the most frequently used features of Improv for Windows.

The Lotus Improv for Windows Quick reference is a ready resource for:

- Working with Improv Categories
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Appox: 136 pages.

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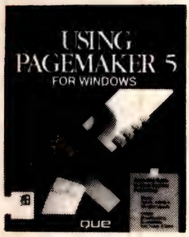
A MUST FOR DESKTOP PUBLISHING



USING PAGEMAKER 5 FOR WINDOWS

Now you can easily complete challenging desktop publishing task! It's the essential resource for creating good-looking documents in the Windows environment.

This book provides step by step instructions to put you on the cutting edge of PageMaker operation and publishing design fundamentals.

Icons highlight the great features of PageMaker 5 - including the Control Palette and the new graphics capabilities.

Edit and create graphics , use special effects and turn out complex layouts. If your a more advanced user, make colour separations for camera ready colour documents . Special chapters focus on proven design strategies and examples for creating business reports, newsletters, transparencies, brochures, and more. Over 1300 pgs

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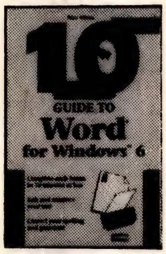

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- Delete, copy, and paste a text block
- Enhance your message by changing the look of your text.
- Check for spelling and grammatical errors.
- Add page breaks and page numbers
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- Create columns and tables for a professional look.

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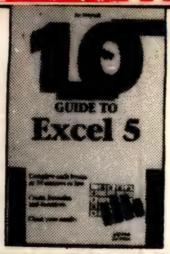

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10 minutes is all you need to learn how to:

- Start and exit Excel 5 for Windows
- Move around worksheets and workbooks
- Create formulas and use built-in functions.
- Delete, copy, and move information
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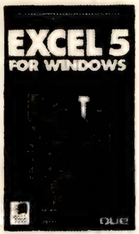

EXCEL 5 FOR WINDOWS QUICK REF

This handy guide clearly explains the most often used commands options and features of Excel. This versatile reference guide helps you become familiar with all the features and operations in Excel 5. Instant access to each function and command allow you to get peak performance from Excel 5.

- 230 pages

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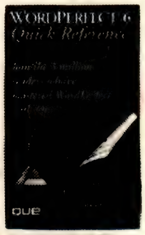

WORDPERFECT 6 QUICK REFERENCE

Find the answer for great word processing results inside Que's WordPerfect 6 Quick Reference! This handy guide clearly explains the most often used commands, options, and features of the latest version of WordPerfect.

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Norton Desktop	$155	$250
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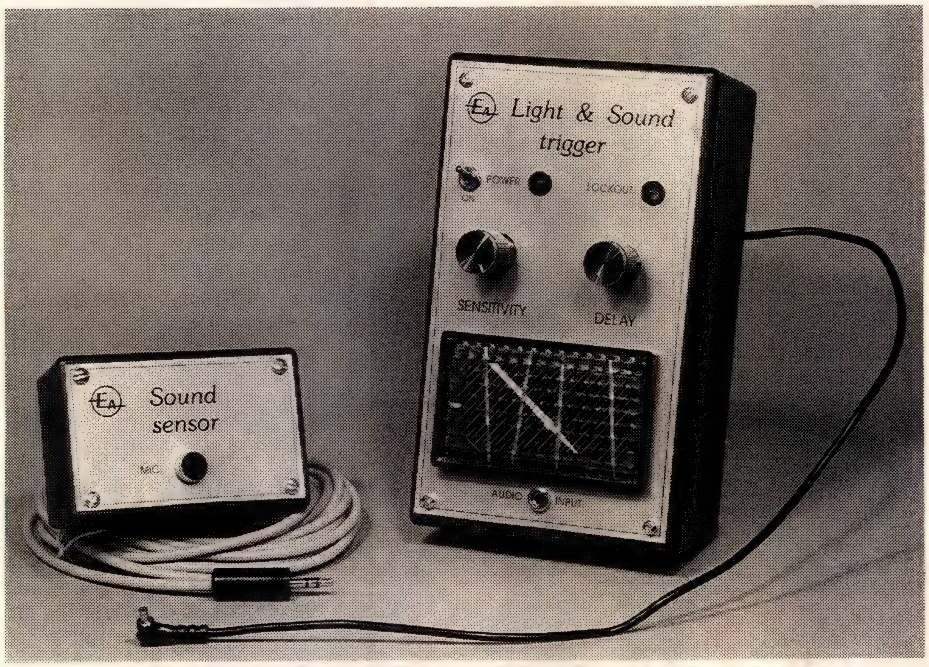
Construction project for beginners

Light and sound trigger

Photographers chasing those special effects often want to activate their camera flash from a sound source, or trigger a second flash from the main one, or even delay the flash by a controlled amount. Here's a simple circuit that will let you implement any of these techniques.

by PETER MURTAGH



This versatile unit will let you enhance your photographic skills in several ways. For example, have you ever wanted to photograph a light bulb breaking, or a drop of water splashing into a cup, or a tennis ball at the exact moment it is struck by a racket?

All of these shots are possible with a sound-activated trigger to fire your photographic flash. However, the unit must also have a variable delay, so that your photo flash can be fired at various times after the trigger, in order to capture the precise instant you require.

Or you might just require a trigger that will instantaneously fire a supplementary flash to give background or fill-in lighting for your photograph. Our 'Light & Sound' trigger will let you do all this.

Back in the 1970s *EA* published several light and sound triggers to fire a photo flash, and the two types of trigger were combined in an *ETI* unit in 1980. Since requests for such a controller continue to come in to our office, we decided to develop anew such a project. We wanted a simple, reliable circuit, which would encourage experimentation.

Before building this project, check that your flash unit has an input socket to take an extension sync cable. Professional units tend to have this socket, but others often only have the 'hot shoe' connection — making wiring a connection a lot more difficult. If your flash falls into this second category, it might be worth buying an older second-hand model to use with the trigger, or upgrading to a professional model.

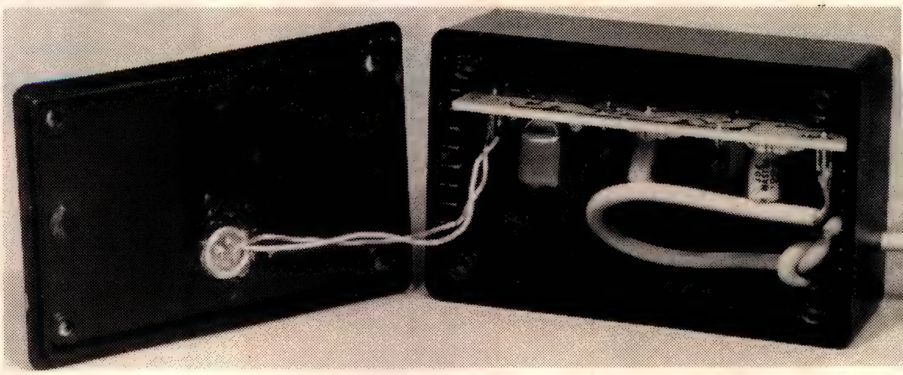
Also, before buying an extension sync cable, check that it fits the socket on your flash unit. There are differences, as we discovered when the 'standard lead' that we bought would not fit one of our National flashes.

Inside a flash unit

The essentials of a flash unit are shown in Fig.1. A transistorised DC/DC converter builds up the low battery voltage to a far higher one, typically from 6V up to around 200V to 500V. This high voltage is applied via a voltage divider to charge up a capacitor (usually around 0.1uF), which is connected in series with the primary of a pulse transformer.

When the camera contacts short out this combination, a high voltage pulse is applied to the trigger electrode of the flash tube. This ionises the gas in the tube, and the flash fires. The whole operation is similar to a capacitor discharge ignition system in a car.

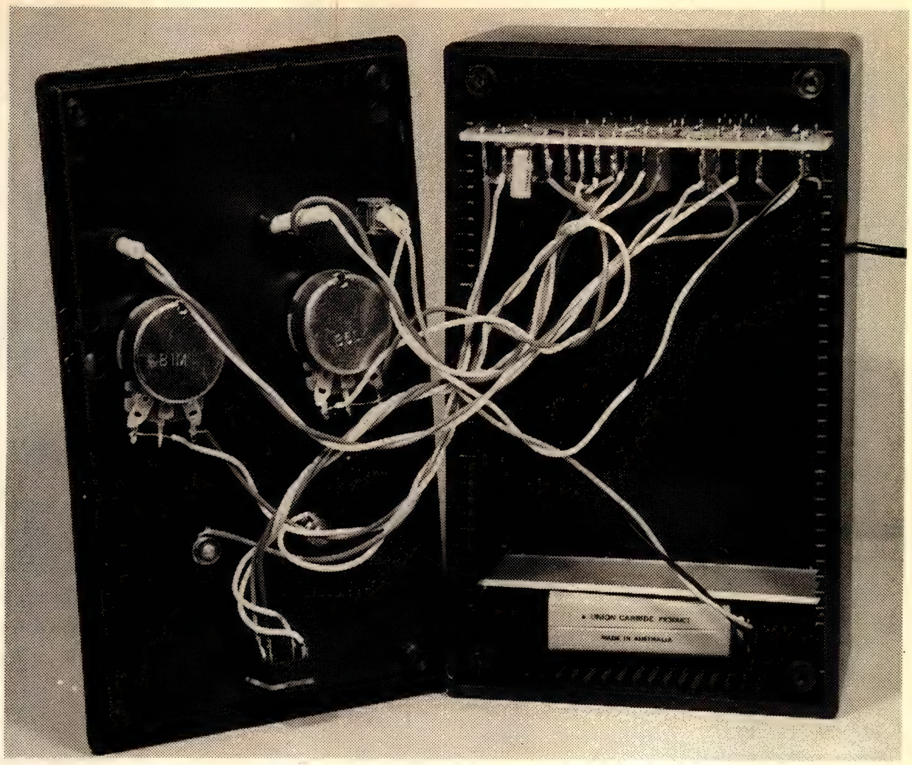
There are various modifications to this basic design. Many units have a silicon controlled rectifier (SCR) built-in to do the switching, which has the advantage of



The sound sensor PCB fits in the jiffy box slots. The twin-core shielded cable at the right supplies +9V and GND from the main units, as well as carrying the sound signal back to it. You can also see the back of the electret microphone insert, which is glued into a hole in the lid of the box.

a high cathode-anode voltage rating. Also, many units nowadays do not completely discharge the capacitor, which gives a faster recovery time.

Because some flash units do not incorporate an SCR trigger, we have used a C106D SCR (the 'D' denotes the 400V model) as the output stage of our circuit to do the actual triggering. This protects our electronics from the flash unit high voltage no matter how the flash unit circuit is designed. Note that the continuous forward blocking voltage rating of an SCR is usually less than its nominal rating — hence we need a 400V model to give us a continuous rating of 300V. You should not use an SCR in this circuit if its specified voltage rating is less than 400V.



There is plenty of room inside the main trigger unit. Note how the PCB fits into the grooves in the side of the jiffy box — to make for easy mounting. A PCB cut-off is used to make a compartment for the 9V battery.

How it works

The flash trigger unit is set up to be fired by a light pulse, unless the sound sensor is plugged in (switch SW1 is built into the audio input socket). So we will deal with light triggering first.

When light shines on the solar panel it produces a very rapid response, measured in only microseconds, and this rapid response, of course, is why we have used it as our sensor. The cell we used is rated at 0.45V, 400mA (Jaycar Cat. ZM-9005). The output pulse is stepped up to several volts, using a standard 8-ohm to 1k audio transformer, and the negative edge is used as the trigger.

IC1 and IC2 are both 555 timers, both operating in monostable mode. The first gives variable delay (from zero to just over 100ms), while the second fires the flash via SCR1 and locks out the circuit for several seconds. At the end of the lockout time, IC2 also resets the SCR.

At power on, capacitor C10 pulls low the reset pins of both timers, to make certain that the SCR is not fired at this stage. Once C10 has charged up, the circuit is then able to work.

The input pulse from the solar cell is fed to the trigger (pin 2) of IC1, with pot RV1 providing variable sensitivity. (This feature is especially useful when using sound pulses.) Pin 2 triggers whenever the voltage drops below 1/3 Vcc (3V in our circuit). So when RV1 is set to maximum sensitivity (lowest resistance), the bias at pin 2 is already about 3.3V — requiring only a very small pulse (-0.3V) to trigger IC1. (At its least sensitive position, a negative-going 2.6V pulse is needed.)

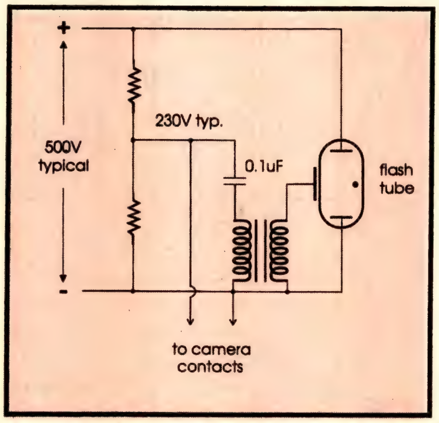
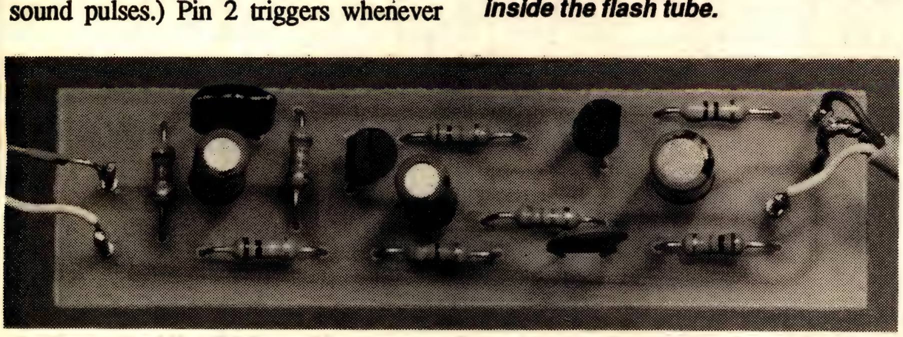


Fig.1: The simplified schematic of a flash unit. The camera contacts discharge the 0.1uF capacitor into the pulse transformer. This creates a high voltage pulse, which ionises the gas inside the flash tube.

Once triggered, capacitor C4 charges up from the output pin 3 (which has now gone high) via the delay pot RV2, until the voltage at threshold pin 6 reaches 2/3 Vcc (6V), and the timer is 'reset'. At this point, the internal discharge transistor connected to pin 7 rapidly discharges C4, and output pin 3 goes low.

The reason why RV2 is connected to pin 3 and not to the supply rail is to allow us to set the pot to a very low resistance, to give a minimal delay. If the pot were connected to the 9V rail, a small resistance would pass a large current through the internal discharge transistor of the 555 whenever the timer was in its reset mode — and this could damage it.

Resistor R17 was added so that there would always be some time delay in the charging up of capacitor C4 (needed when RV2 is set to zero). Without it, the output at pin 3 would not rise above 6V — because capacitor C4 would instantaneously charge up. This limits the pulse fed to IC2, which could result in unreliable triggering. If you find that your flash will not fire on minimum time delay, then increase the resistance of R17 above 1.5k.



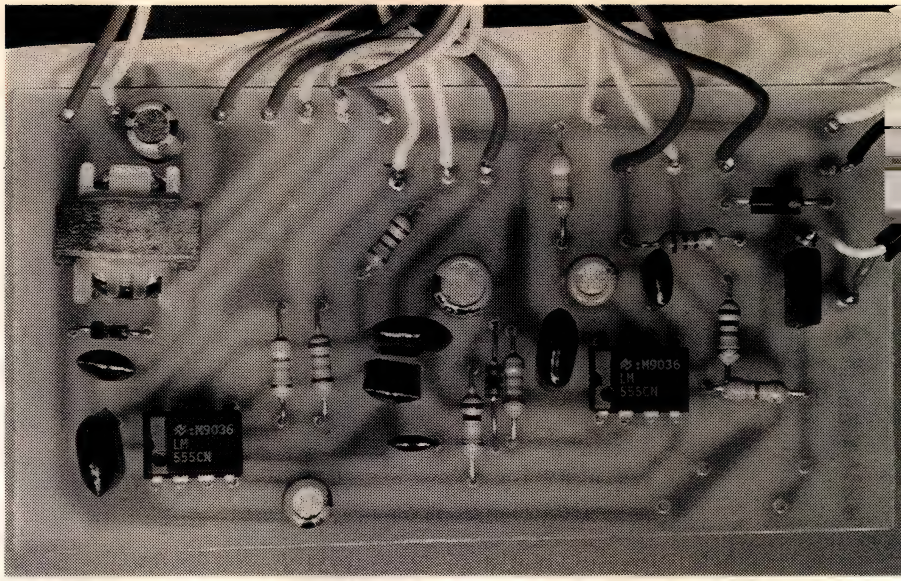
A close up of the PC board in the sound sensor attachment for the main trigger unit. Use this picture in conjunction with the smaller overlay diagram, as a guide when you are wiring up this board.

Adding this resistance means that the minimum delay is a negligible 165us (t = 1.1 x R17 x C4).

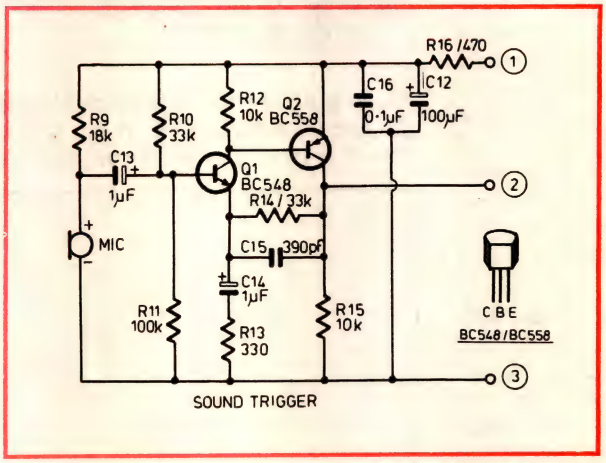
Just as IC1 was triggered on a negative-going pulse, so also is IC2. This occurs at the end of the delay time (if any). The C6/R3 combination ensures that pin 2 of IC2 is kept high until this pulse arrives. IC2 is now 'set' and the output at pin 3 goes high for about 2s. Diode D2 has been added to prevent the positive edge of the triggering pulse going higher than the supply rail.

When IC2 is triggered, pin 3 goes high and provides the gate current for the silicon controlled rectifier SCR1. The SCR requires quite a large gate current to latch it on, so the 330-ohm value of resistor R6 is reasonably low. While pin 3 of IC2 remains high, the 555 provides both gate and anode current to keep SCR1 on. Its monostable delay provides a lockout time of a few seconds to prevent the flash being accidentally re-triggered during that time.

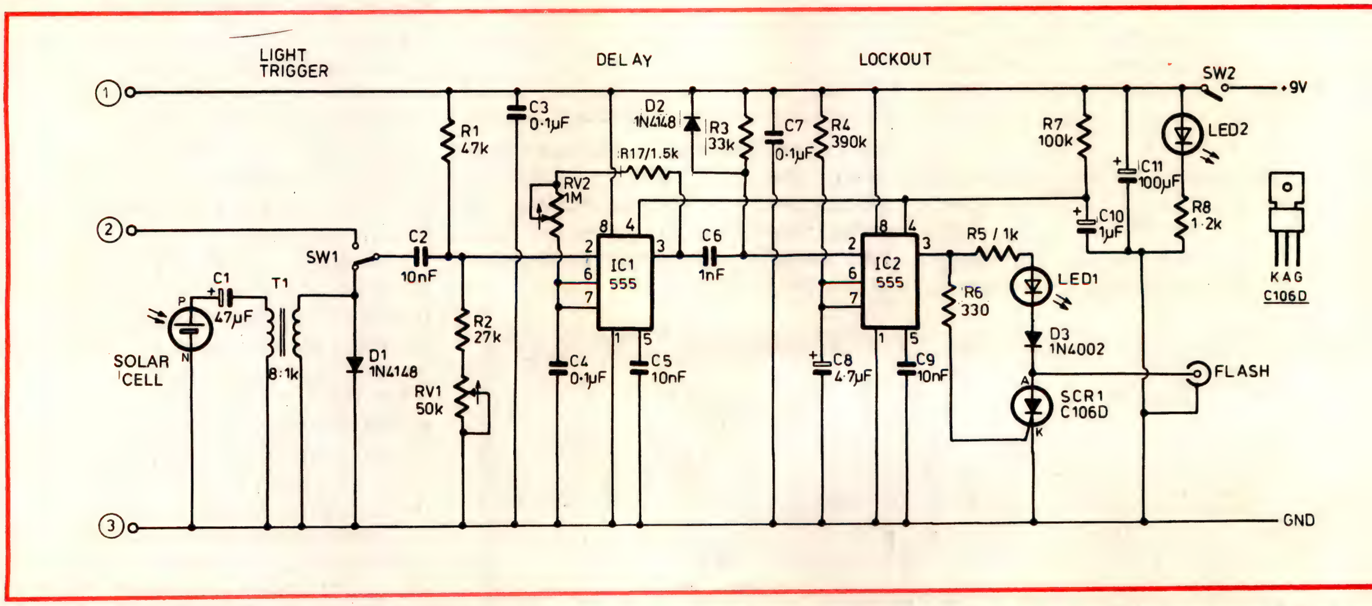
Fig.4 shows that an SCR is a PNPN device, which can be thought of as two complementary transistors. The current provided at the SCR's gate switches on the NPN transistor, which then switches on the PNP one. Because each transistor provides the other's base current, this explains why an SCR latches on when triggered, and can only be turned off by applying a reverse voltage or removing its source of anode current. Obviously, once the timing period of IC2 is over, pin 3 going low means that SCR1 will be deprived of its current. While SCR1 is



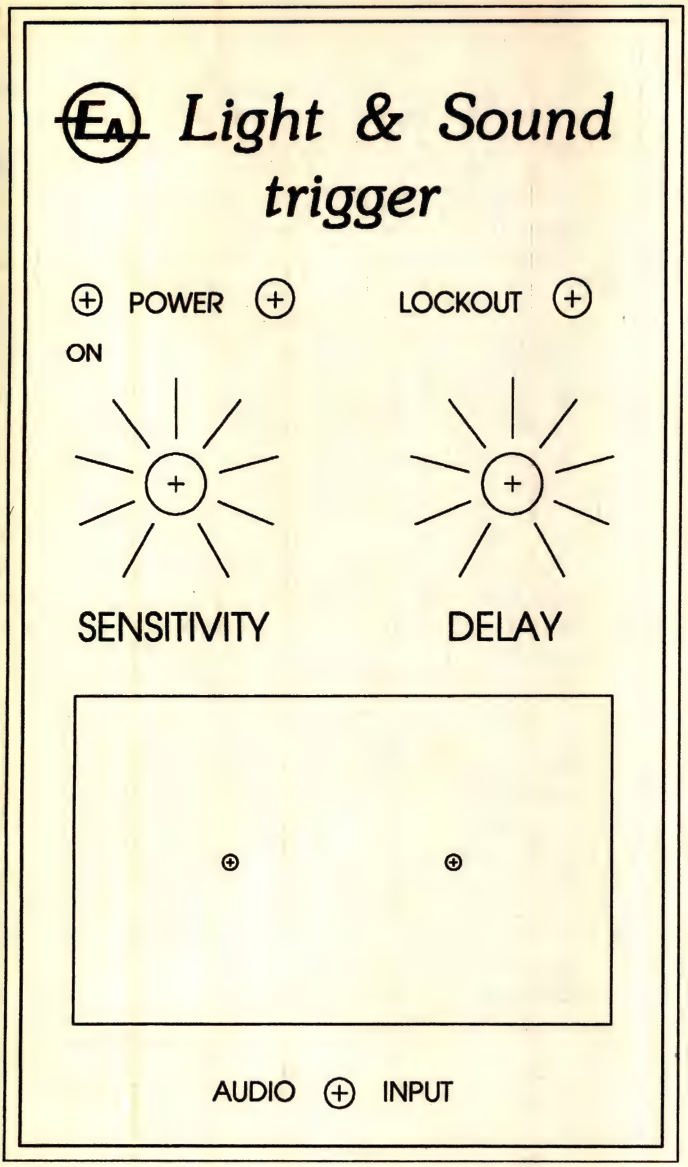
And here's a close up view of the main trigger board, which supports the circuitr used to process the signal from the light sensor, and also to provide the timin delay and lock out functions for the signals from both sensors.

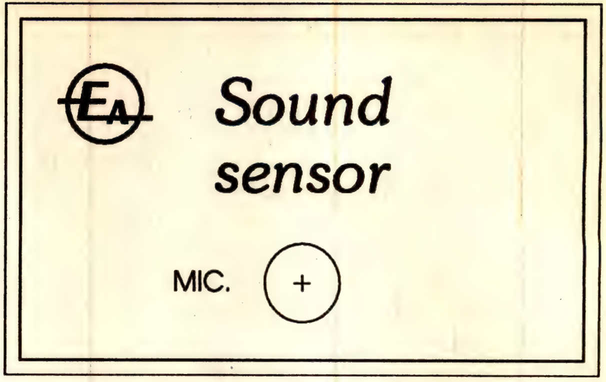


As you can see from th schematic, the add-o sound trigger circu consists of a simp two-transistor pre-am fed by a low cost electr mic insert.

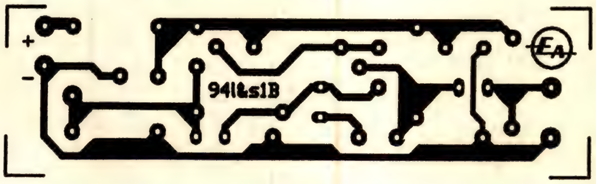


Here is the schematic for the main section of the trigger unit, and also for the light trigger sensor. Two low cost 555 time chips are used for the delay and lock out functions, driving a C106D plastic pack SCR. The latter performs the final job o triggering a standard electronic flash unit, via the normal camera connector.

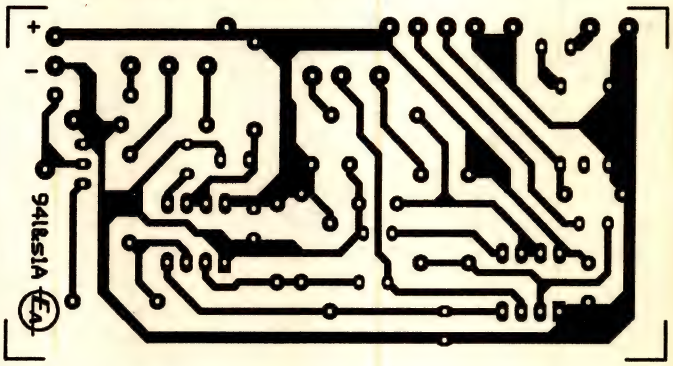


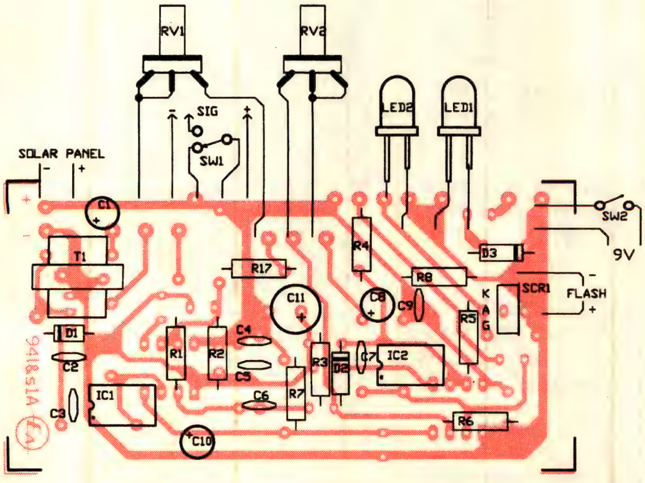


Above is the art work for the UB5 jiffy box, while at the left is the art work for the UB1 jiffy box. These boxes allow PCBs to slot into the grooves in the sides.



As usual we have provided the PCB patterns for those who wish to etch their own boards. Before trimming the boards, check that the corner markers coincide with the dimensions of the grooves in your jiffy boxes.





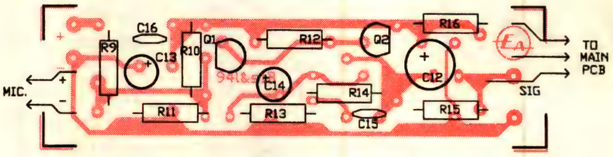


Fig.2 (left):This is the overlay diagram for the main PCB, built around two 555s. The first IC allows the trigger from either the solar cell or sound sensor to be delayed by up to 100ms, while the second fires the SCR and locks it out for 2s to prevent accidental re-triggering.
Fig.3 (right): The sound sensor PCB is a simple two-transistor audio amplifier with an AC gain of around 100. Plugging into the audio input on the main unit automatically switches the input from light to sound triggering.

triggered, red LED1 will glow. This indicates that the firing action is locked out, which means that the SCR has in fact been triggered — your flash should have fired. Because the SCR anode can make contact with the high voltage inside the flash unit, IC2 needs to be protected. This is provided by diode D3, which has a higher reverse voltage breakdown than LED1.

Green LED2 is a power-on indicator, and C11 is a smoothing capacitor for the power supply. Capacitors C3 and C7 provide high frequency bypassing for the two ICs, while C5 and C9 also help prevent false triggering.

Sound triggering

If you wish to trigger the flash unit from a sound impulse, then you will need to use the additional sound sensor unit. This is activated by inserting the 3.5mm stereo phono plug into the audio socket, which connects +9V and GND to the sound sensor and also switches the triggering from light to sound. The microphone is an electret insert, which picks up the sound you wish to use as your trigger, e.g., a popping champagne cork or a smashing light globe. This signal is amplified by the two-transistor complementary Darlington pair amplifier (Q1 and Q2).

The audio amplifier circuit is a standard one. Resistor R14 provides 100% DC negative feedback for stability, while the AC gain at typical audio frequencies is around 100. The amount of gain is determined by the negative feedback fraction (approximately its inverse), which is the voltage developed across components C14 and R13 compared to that developed across C14, R13 *and* R14. To reduce the risk of accidental triggering, capacitor C15 offers a low impedance bypass for RF — that is, it decreases the gain at high frequencies.

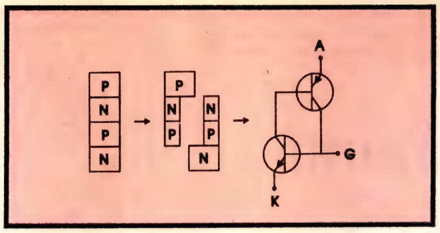


Fig.4: The SCR used to trigger the flash unit is effectively a combination of a PNP and NPN transistor.

If you wish, resistor R13 could be replaced by a 500-ohm trimpot. This would allow easy adjustment of the gain of the amplifier, which would work (together with the sensitivity pot RV1) to give greater control over the triggering of the main unit.

Construction

We have designed the two PCBs to fit into the slots on the sides of the two jiffy boxes specified. However, we have noticed that there are slight variations in the boxes supplied from different stores — so don't trim the excess off the PCBs until you have checked that our corner marks correspond to your slot widths! (The UB1 and UB5 boxes which we used both came from Dick Smith Electronics, Cat. Nos. H-2851 and H-2855.)

Start your construction by soldering the various components to the PCBs. While it is better to solder the more robust components first, like the resistors and capacitors, it is probably more convenient to leave the caps until last — rather than limiting the space early. For example, it is far easier to insert the two ICs before you position the components which surround them. Because there are quite a few connecting wires to be joined to the PCBs, as usual we used PCB pins to make the soldering easier.

Next prepare the two boxes by drilling the holes for potentiometers, switches, LEDs, etc. The solar panel has its own bolts at the back to fasten it to the front of the main box. Mark the positive terminal to make it easier to identify when it's time to add the connecting wires. When this is done, stick on the front panel artwork (the patterns are given actual size in Fig.5) and fit the controls and sockets.

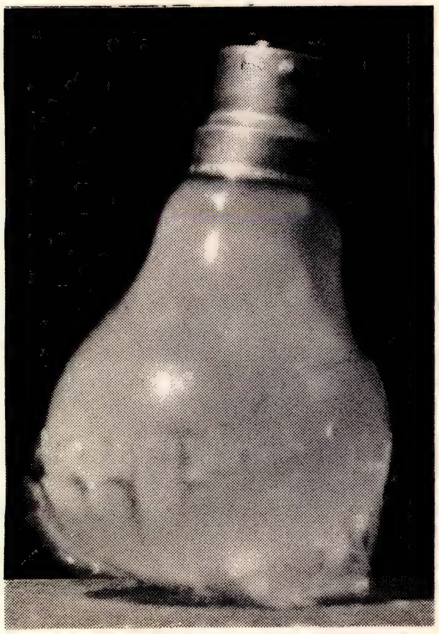
For the lead to connect the sound trigger to the main unit we used several metres of twin-core shielded cable. We made it reasonably long so that we could place it well away from the flash unit in certain circumstances (e.g., near a bird feeding). One core is used for the signal, the other for +9V, while the shielding braid provides the GND connection.

On the other hand, we made our extension sync lead to the flash gun quite small, which means that the flash and trigger must be positioned close together. This lead is an ordinary extension one, available from photographic stores. You need to retain the male plug on the lead to connect to the flash unit.

In order to save a plug and two sockets, we soldered the audio lead to the sound trigger unit, and the flash lead to the main circuit. We also figured that this would stop us losing the leads in the future!

Testing time

If all goes well (and Murphy is on



Left: A light globe shatters, some 7.5ms (half a division on the delay control) after the sound trigger is activated. The sensitivity control was set at half. All the action photos were taken with a single lens reflex camera, with an 80mm zoom on F16, using 100 ASA film.

Right: This photo shows a small hammer striking a light globe, again with the delay time set to half a division.

Opposite left: The dying moments of a bursting balloon! This shot was also taken 7.5ms after the balloon made contract with a sharp pointed object.

Opposite right: An 'electronic mousetrap! About 15ms (delay set to one division) after the 220uF capacitor set out the mousetrap, the trap is half way to capturing it!

PARTS LIST

Miscellaneous

PCB 88 x 46mm, coded 94l&s1A
PCB 77 x 22mm, coded 94l&s1B
9V battery
SPST power switch SW2
3.5mm chassis mount stereo socket/SW1
DPDT switched; (Altronics Cat. P0092)
3.5mm stereo plug
0.45V, 0.4A solar cell
(Jaycar, Cat. ZM-9005)
UB5 83x54x28 jiffy box
UB1 150x90x50mm jiffy box
electret microphone insert
twin-core shielded cable
extension sync flash lead
1k:8 ohm audio transformer
PCB pins, hookup wire, solder, etc.

Resistors

All 1/4W, 5%

1	47k	R1	yellow-purple-orange
1	27k	R2	red-purple-orange
3	33k	R3,R10,R14	orange-orange-orange
1	390k	R4	orange-white-yellow
1	1k	R5	brown-black-red
2	330	R6,R13	orange-orange-brown
2	100k	R7,R11	brown-black-yellow
1	1.2k	R8	brown-red-red
1	18k	R9	brown-grey-orange
2	10k	R12,R15	brown-black-orange
1	4700	R16	yellow-purple-brown
1	1.5k	R17	brown-green-red
1	50k lin pot		RV1
1	1M lin pot		RV2

Capacitors PC-mount electrolytics

2	4.7uF,25V	C1,C8
2	100uF,16V	C11,C12
3	1uF,50V	C10,C13,C14

Capacitors polyester (greencap)

3	10nF	C2,C5,C9
4	0.1uF	C3,C4,C7,C16
1	1nF	C6

Capacitors ceramic

1	390pF	C15

Semiconductors

2	1N4148 signal diodes	D1,D2
1	1N4002 power diode	D3
2	LEDs (red and green)	LED1,LED2
1	BC548 NPN transistor	Q1
1	BC558 PNP transistor	Q2
1	C106D 400V SCR	SCR1
2	555 timers	IC1,IC2

holidays) the unit will work straight away; but let's do a few checks anyway! Turn on the power via switch SW2, and the green 'power-on' LED2 should light. However, at this stage, the 'lockout' red LED1 should *not* come on — if it does, check out the reset-delay circuit around R7/C10.

Next use the light trigger. Start by setting both the sensitivity RV1 and the delay RV2 to their lowest settings (fully anticlockwise), but don't connect the output flash unit yet. A flash fired at the solar cell should result in LED1 coming on straight away, and staying on for about 2s. Now set the delay to maximum, and fire again. There should be a slight delay (100ms) before LED2 glows, and once again it should stay on for 2s.

If you have troubles at this time, you might like to increase the delay time to make it easier to find the fault. Solder a 2.2uF capacitor in parallel with C4, and the maximum delay should be a few seconds. Measure the voltage at pin 3 of IC1 — it should go from low-to-high when the flash fires and high-to-low after the 100ms delay has elapsed. Similarly, pin 3 of IC2 should go low-to-high at the end of the delay time, and low again after a further 2s.

Once the main circuit works, check out the sound sensor. Because the sound pulse will vary so much, you need to adjust the sensitivity control so that the ICs trigger reliably, but not on background noises. This is a trial and error process, varying the RV1 sensitivity. Remember that the more sensitive the setting, the smaller the audio pulse needed to trigger the circuit. The main reason why we included the lockout LED was to give you a clear indication that the trigger has fired — very useful at this setup stage. Once both units have checked out correctly, plug in the flash which you intend to use with the trigger, and make certain that SCR1 does fire it. Because IC2 provides the current to keep SCR1 latched on, it shouldn't matter whether your flash unit has an internal SCR trigger or not. Some earlier *EA* designs couldn't trigger all types of flash units because they relied on the charged up capacitors in the unit to provide the anode current for SCR1. If the flash had an internal SCR trigger, then the only latching current available would be that SCR's (insufficient) gate current.

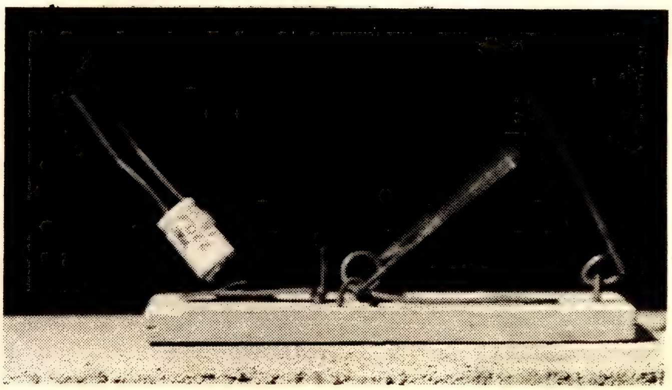
Our photos

Experimenters might be interested in the setup that we used for our time delay photos. Our single reflex lens camera, fitted with a 28 - 80mm zoom lens, was clamped to a table about 1m from the object being photographed. Most of the shots were taken with maximum zoom of 80mm, on F16, using standard 100-ASA black and white film. The flash unit was also mounted about 1m from the object, but above and to the left, in order to minimise reflection and to give more background illumination. The 'sound and light trigger' was positioned next to the flash unit (to allow the sync cable to be plugged in), and the 'sound sensor' was placed off to the side, 350mm from the object being photographed.

For all our photos, the 'sensitivity' was set to half. This setting didn't seem to be too critical, though we did find that very high settings caused the flash to react to the noise of the camera shutter action. The setting on the 'delay' varied from zero to 120ms. Note that the nominal maximum delay for the trigger unit (determined by RV2 and C4) is 110ms (1.1 x 1M x 0.1uF); however, our unit actually measured 120ms, owing to component tolerances. This meant that each of the eight divisions on the the delay scale was 15ms — which is the figure quoted in the photo captions.

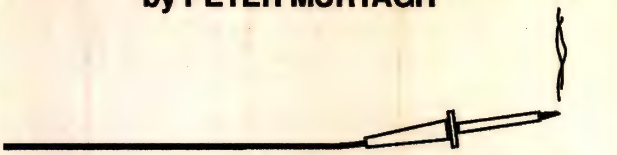
To take the photos, the lights were turned off in the darkened room, the camera shutter was held open, and then the light globe was dropped, etc. After the flash had fired, the shutter was released and the lights were turned back on. We found that the procedure worked more effectively if two people were involved — for obvious reasons!

Over to you now. Once your trigger unit is completed, it's time to use your imagination to find interesting events to photograph. ❖



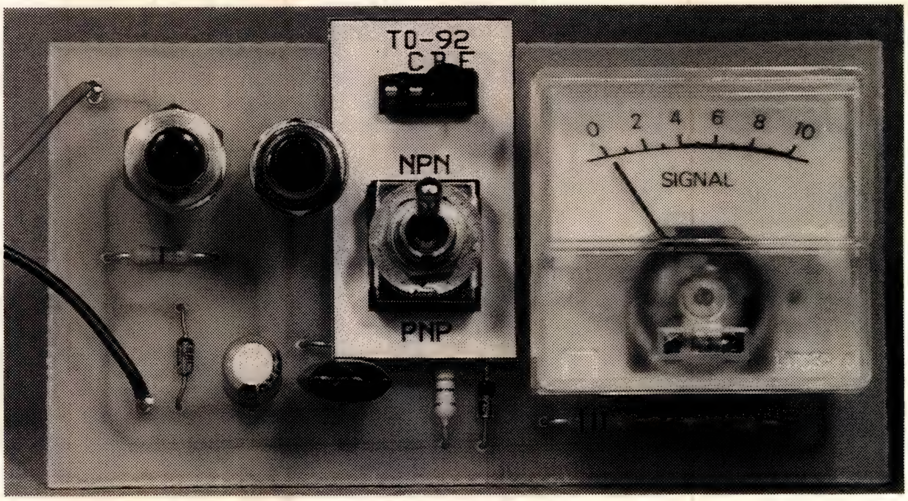
Experimenting with Electronics

by PETER MURTAGH



Transistor gain tester

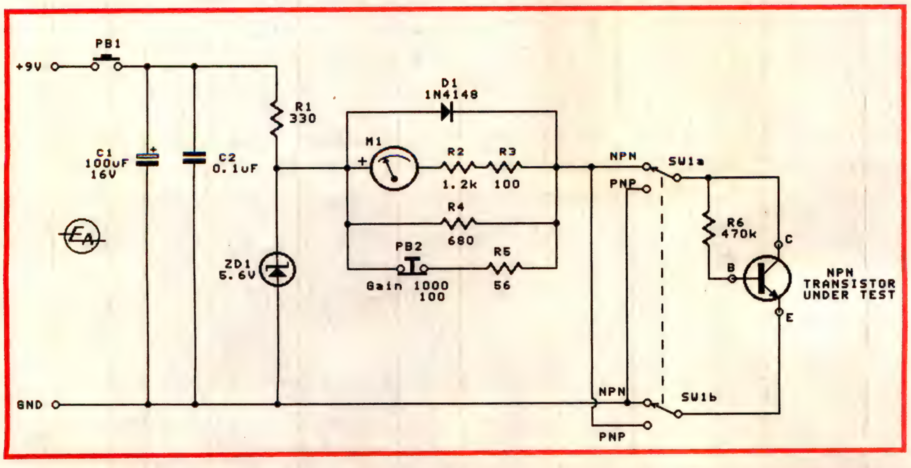
A BC548 transistor has a quoted gain somewhere between 100 - 800, but what is the actual gain of any individual transistor? Build this simple gain tester, and you will be able to find out. The tester will also allow you to determine whether a transistor is NPN or PNP, and to identify its collector, base and emitter leads. It will also tell you if it is 'kaput'!



A transistor gain tester is a very useful device. Often it will allow you to substitute a transistor from your 'junk box' for a different type as specified in a circuit — thus saving you money. Other times you may need to use matched transistors, as for example in the push-pull output of our December 'Power amplifier module'. Or your needs might be far simpler — does a transistor salvaged from an old board still work, and if it does, which lead is which?

Incidentally, our tester has two ranges: the 0 - 1000 gain range for small signal transistors (like the BC548), and the lower 0 - 100 range for power transistors (like the BD139/140). To protect the meter movement, the tester defaults to the 1000 gain — pushbutton PB2 must be depressed for the 100 range. This means that the needle should not slam into the end stops because you have accidentally selected the wrong scale. And if you are measuring a low gain transistor, then as soon as a reading measures less than 100, you simply press PB2 to make the tester 10 times more sensitive.

The meter used in the circuit (DSE Cat. No. Q-2100) is an AM/FM level meter, with a 0 - 10 signal scale. We have used this scale to represent a gain range of either 0 - 100 or 0 - 1000. The meter's full scale deflection (FSD) occurs with a 250uA current, and it has a 1k impedance. Since there is no AC signal in our application, we needed to know the meter's DC resistance — which we measured at about 640 ohms. If you plan to use a different meter, then its specifications should be very similar to this model's. Otherwise, you will have to calculate your own values for the shunt resistors (see the 'How it works' section).



The schematic shows how simple the tester circuit is. The normally open pushbutton PB1 is used to power up the tester, while normally closed PB2 defaults to the 0 - 1000 gain scale, which means that less current flows initially through the meter.

Construction

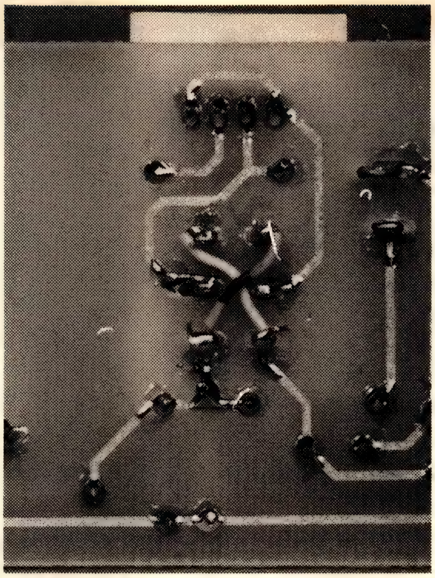
As you can see in the first photo, we opted to fix the two pushbuttons, the NPN/PNP switch and the meter directly to the PCB. While this meant that we had to cut various slots for the lugs on these components, it meant that we didn't need to mount the circuit in a jiffy box. But if you do wish to use such a box, then the board measurements (88 x 46mm) will allow you to use the slots in a UB1 jiffy box (150 x 90 x 50mm).

Note also the socket for the transistor under test. The most economical solution that we could find for a test socket was to use one half of an 8-pin DIL socket. The advantage of this system is that it is very easy to spin a transistor through 180° if its leads are in the order EBC rather than the CBE of the BC548. The disadvantage is that you have to bend the leads of many small signal transistors to make all three line up in a straight row.

Also, since only three contacts are needed, it's possible to cater for various transistor layouts by duplicating the emitter contact at each end of the socket. (More on this later.)

Start your construction by making the slots for the lugs on switch SW1, pushbuttons PB1 and PB2, and the meter M1. These slots are about 2mm long, but only about 0.1mm wide. Drill one hole through the centre of the pad, then drill two more hole — one to each side of the first — with as little material between holes as possible. But don't go too close, or the drill bit will slip back into the previous hole. Then join all three holes up. We did this by inserting the spinning drill bit in each hole, then gently angling the drill, first from one side and then from the other. Be careful not to flex the bit too much, or it will snap!

Once the slots have been drilled — and checked that they are large enough — proceed to insert and solder the smaller components (taking care with the polarity of the storage capacitor C1 and the two diodes D1 and ZD1). Note that the zener diode is *reverse biased* — which is why its anode is connected to ground.



You can see the two loops that must be added to the back of switch SW1. This prototype tester does not have the rectangular areas of copper, which allow you to fix the two pushbuttons and meter more firmly.

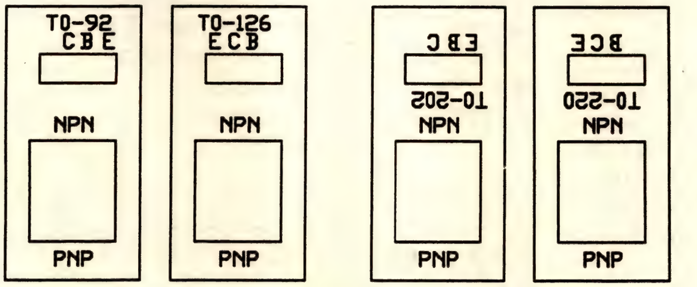


Fig.3: Here are the patterns for paper overlays to help you remember which contacts on the transistor socket are used for each transistor type.

It's now time to solder the two pushbuttons and meter. On the PCB, there are large rectangles of copper near their slots. The lugs can be bent over and soldered to them, to make a stronger mounting. Finally, add the connections to the 9V battery. Remember that you must add two wire loops to the back of the DPDT switch SW1. These connect the top lug of each pole with the bottom one of the other side (see Fig.1).

You might have noticed that we haven't included a breadboard layout for the transistor tester. This is because we felt that this handy device is something that you would wish to keep, rather than one whose components would be recycled.

Cut out the relevant overlay (see Fig.3) for the transistor you wish to test, place it over switch SW1 and the transistor socket, and you are ready to go!

If you know the type of transistor under test (NPN/PNP), and also the configuration of the leads, simply plug the transistor into the socket with the correct leads for collector (C), base (B) and emitter (E); then press button PB1 to power up the circuit. With this setup, the 0 - 10 scale on the meter represents gains from 0 - 1000. If the gain measures less than 100 ('1' on the scale), press down PB2 as well. The meter is now 10 times more sensitive, so the 0 - 10 scale now represents gains up to 100.

To determine whether the transistor is NPN or PNP, simply plug it in, and read off the gain with switch SW1 in both of its positions. Because of the low 5.6V used in the circuit, there will be no reverse-voltage breakdown current; hence, only with SW1 in the correct position will the transistor produce a reasonable gain reading.

Similarly, if the collector and emitter leads of the transistor are reversed, then the gain won't be as large. So the general rule is: the correct NPN/PNP setting, with the C, B and E leads in their correct sockets, will give the largest gain.

The obvious exception to this rule is when the transistor has a short-circuit (usually between the collector and emitter). When this occurs — even without a base current flowing — the meter needle will 'slam' into the top end stop. (The presence of diode D1 and resistors R2 and R3

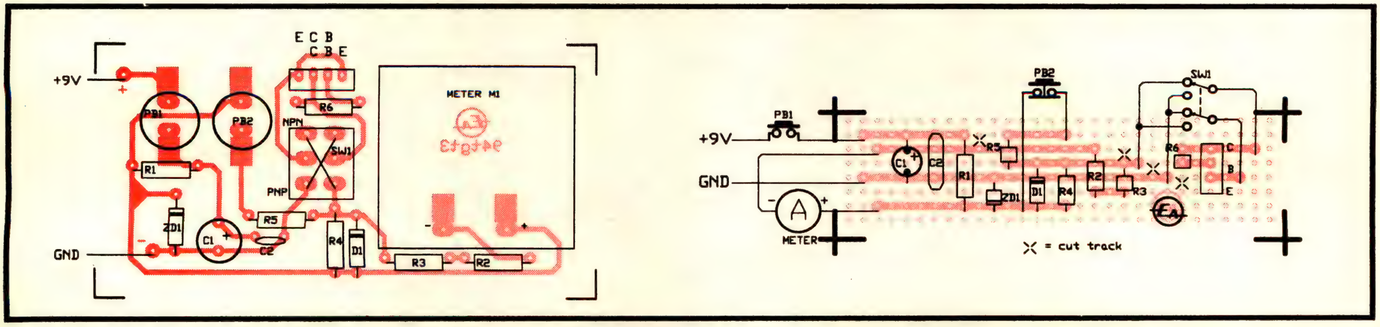
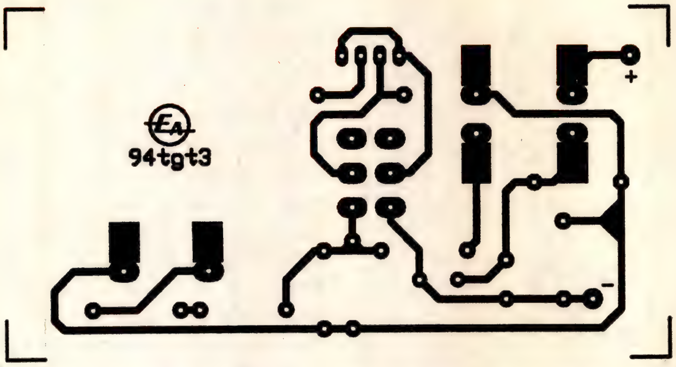


Fig.1 (left): The component layout for the PCB. You have to cut 2mm long slots in the board for the buttons, switch and meter if you decide to solder them directly to the board. Fig.2 (right): The layout diagram to build the circuit on stripboard. In this version, the buttons etc., are connected by leads to the stripboard, rather than being soldered directly to it. Remember to cut the copper track at all locations marked as 'cut track'.



The PCB pattern is given here actual size for those who wish to etch their own boards.

limits the maximum current to about 320uA, thus protecting the meter.) And the converse should also be obvious — with an open-circuit (some internal connection is broken), you will get a gain of zero no matter in what pattern you plug in the transistor leads.

Changes

Transistor leads are arranged in every conceivable pattern. With the transistor upright, and viewed from the front, the pattern for the TO-92 package (BC548/558) is CBE; for the TO-126 (BD139/140), ECB; and these are reversed for the TO-202 (EBC) and the TO-220 (BCE). The 4-pin socket can handle all of these, but take care not to become confused!

If you only intend to check small signal transistors, then the CBE pattern will suffice. So you could cover up the first pin on the socket, or even cut it off! The simplest method is to make a photocopy of Fig.3 and use it as an overlay. This will indicate which contacts are being used.

How it works

The tester works by applying a constant current between the collector and base of the transistor being tested, then using the meter to measure the collector current. The base current is close to 10uA. So, for a current gain of 1000 and 100, this means that the collector current will be around 10mA and 1mA, respectively.

Various shunts are used to bypass most of this current, so that the maximum meter current does not exceed 250uA on either scale.

Ideally, the base resistor R6 should connect directly to the output of the zener diode ZD1, to give a constant voltage and hence a constant base current. However, to be able to connect R6 to the appropriate end of the zener (the cathode for an NPN, and the anode for a PNP transistor), would have required SW1 to be a *three*-pole double-throw switch.

While this could have been achieved with a rotary switch, we opted instead to use only a DPDT switch, by connecting R6 *after* the load resistance. Since the combined resistance of M1, R2, R3, R4 and R5 is only around 500 ohms — dropping to 50 ohms with R5 connected — this is very much less than R6's 470k. Hence this modification has little impact on the base current.

Consider the situation with the meter measuring FSD. This means that a current of 250uA flows across a combined resistance of 1.94k (M1 = 640 ohms, R2 = 1.2k and R3 = 100). Applying and rearranging the Ohm's law equation:

Voltage = current x resistance
= 250uA x 1.94k
= 0.5V

Hence, the voltage across the 470k R6 is 4.5V (the constant 5.6V of the zene diode ZD1, less the 0.5V drop across tl load, less another 0.6V drop across tl base-emitter junction of the transist under test); giving a base current 9.6uA (4.5V/470k).

As mentioned before, if too much cu-rent flows through the transistor, diod D1 and resistors R2 + R3 provid protection. Assuming that D1 will con duct whenever the voltage exceed 0.6V, this means that the voltage acros M1, R2 and R3 will never exceed thi value. Since (from above) the combin resistance of M1, R2 and R3 is 1.94 the maximum current in the meter wi be limited to around 300uA (0.6V/1.94 = 309uA).

Because R2 is roughly twice the resis tance of M1, it should be obvious tha this 300uA maximum current would b some three times larger without R2 i series with M1.

Similar calculations provide th values of the resistor shunts. For full scale deflection, the voltage drop acros M1, R2 and R3 is 0.485V (calculate above), which is also the voltage dro across the shunts. If the 100-gain scal is in use, the total collector curren will be 960uA (100 x I_B) — o which 710uA will flow through th shunt, and 250uA through the mete This requires a resistance value for R of 683 ohms (0.485V/710uA) — clos enough to 680 ohms.

For the larger collector currents whic flow with gains up to 1000, the maximum shunt current is 9.35mA (9.6mA 250uA); so its shunt resistance shoul be 51.9 ohms.

By connecting 56 ohms (R5) in parallel with the existing 680 (R4), this give almost exactly the required value (R4 R5/(R4 + R5)). Because button PB2 ha its contacts normally closed, the mete defaults to the 1000 gain scale; and thi shunts much more of the collector current around the meter, because resisto R5 is connected into the circuit.

This default helps protect the mete movement, because high-gain transistors would cause the needle to g off-scale on the 0 - 100 range. Selec this latter scale — by pressing but ton PB2 — only when you find tha the gain reads less than 100 on the 0 1000 scale.

As usual we have two capacitors t help stabilise the supply voltage. C1 i the storage capacitor, which also lower the input impedance of the circuit (al lowing the battery to maintain its voltage even when its internal resistanc increases with age); and C2 bypasse any RF interference.

PARTS LIST

Miscellaneous

PCB 88 x 46mm, coded 94tgt3
level meter (250uA FSD)
DPDT miniature switch SW1
SP pushbutton (NO) PB1
SP pushbutton (NC) PB2
9V battery
hookup wire, solder, etc.

Resistors

All 1/4W, 5%

1	330	R1	brown-red-red
1	100	R3	brown-black-brown
1	680	R4	blue-grey-brown
1	56	R5	green-blue-black
1	470k	R6	yellow-purple-orange

Capacitors

PC-mount electrolytics:
1 100uF,16V C1
Capacitors polyester (greencap):
1 0.1uF C2

Semiconductors

1 1N752 5.6V zener diode ZD1
1 1N4148 signal diode D1

Resistor R1 drops the supply voltage from 9V to the 5.6V level set by the zener, and has the largest value which will still allow the maximum 10mA collector current to flow (3.4V/330 = 10.3mA).

Finally, the DPDT switch SW1 reverses the voltage polarities, depending on whether an NPN or PNP transistor is being tested. This means that the same collector, base and emitter positions on the socket can be used for either type of transistor.

Accuracy

The transistor gains tester really is only a comparison tester, and should not be taken as giving accurate, absolute gain readings. This is because the gain of any transistor depends on the size of the base current, and the size of this current will depend on the transistor's final use in some circuit. Our tester only measures the gain for a base current close to 10uA.

Also, the tester will give a different measurement for the same transistor, depending on whether the 100 or 1000-gain scale is used. This is because the base current does vary slightly with resistor R5 in and out of the circuit. For example, a BC556 transistor showed a gain of just over 100 on the 0 - 100 scale, but a reading of around 250 on 0 - 1000.

A check with a micro-ammeter showed that the base currents did vary slightly — being 9.5 and 10.6uA, respectively. As mentioned before, such a variation in base current could be removed by using a third pole on the selector switch SW1 to maintain a constant voltage source.

However, despite these limitations, you should still find that our simple 'Transistor gain tester' is a very useful device. Its primary purpose is to check whether a particular transistor works and to identify its leads, as well as to compare or match the gains of different transistors.

Transparencies

As usual, a high contrast, actual size transparency (negative) for the PCB used in this circuit is available for only $2. This will allow you to etch your own printed circuit board.

This special price applies for transparencies for all projects in this series only. Write to *EA*'s reader services division.

Happy experimenting — and please send us your comments on the circuits we have published, as well as ideas for future projects. ◆

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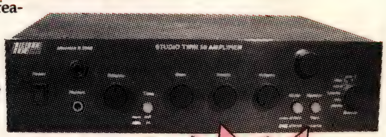

This fantastic new amp has all the features of commercial units costing hundreds of dollars more. Using TIP 142/147 transistors it is capable of producing a total of 47 Watts per channel RMS into 8 ohms. Features 6 inputs, bass, treble and balance controls, headphone jack, tone defeat switch etc etc. Incorporates polyswitch protection.

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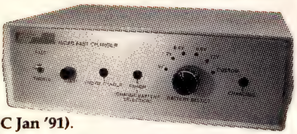
Champ 0.5 Watt Amp Kit

NEW

Physically about the same size as a standard 9V battery, this compact little amplifier delivers 0.5W of power into 8 ohms from a 9V battery. Ideal for beginners, experimenting and small audio projects. Designed around the LM 386 audio amplifier IC, the circuit uses only a handful of components and works from 4 to 12V DC.

K 2115 **$5.95**

High Capacity Fast Charger for Nicad Batteries Kit



(SC Jan '91).

This charger is designed to operate from a 12V battery. It can charge 6-12V nicad battery packs at up to 6A, or you can custom wire the unit to charge battery packs up to 30V at a reduced current. In operation the circuit will recharge a typical nicad racing pack in about 20 minutes. **Features:** • Fast charge rate • Switch selectable voltage setting in 1.2V steps from 6-12V • Fully punched and screened front panel • State of the art digital circuitry

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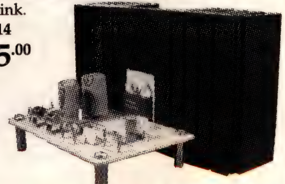

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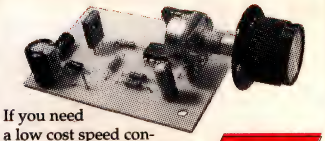

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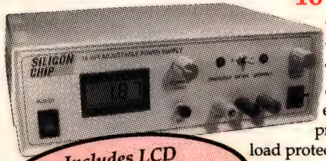

This 1.23 V to 40 V adjustable power supply is designed for heavy-duty work. It uses a high efficiency switching regulator circuit. Features preset voltage and current limiting, full overload protection (with indicators) and an LCD panel meter for precise voltage and current readouts.

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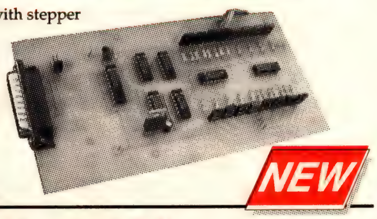

If you have ever wanted to experiment with stepper motors then this kit is ideal. It plugs directly into any standard printer port and can control two stepper motors as standard, but can be cascaded to control up to eight stepper motors. Requires external 12 Volt power supply.

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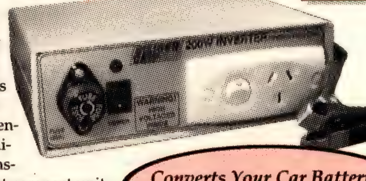
NEW



This compact 200W Inverter can drive many mains power appliances including power tools, fluorescent and incandescent lights, TV's etc, using a 12V power source. It is ideal when camping, on building sites, on farms or as part of a solar power installation. This inverter, uses high frequency switching techniques which eliminates the need for bulky, heavy transformers enabling a very light weight compact unit. Features: • Small physical size • Very low standby current • Modified square wave output • Peak-peak voltage equal to mains sine wave • Low battery voltage shutdown • 30A - over current limiting • Fuse protection • Fully isolated output for safety • 2kg mass

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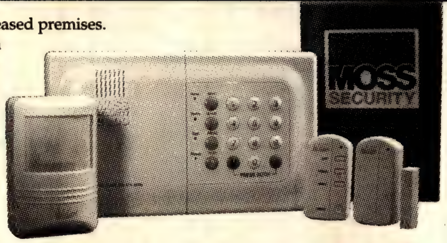

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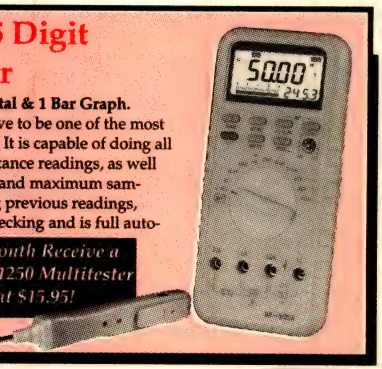

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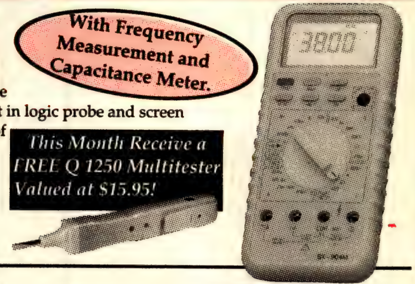

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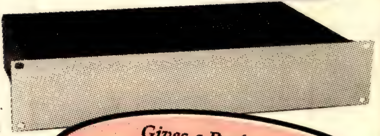

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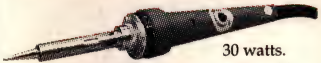

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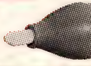

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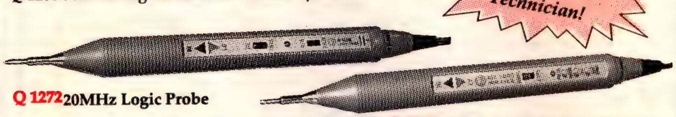

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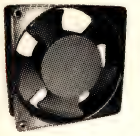

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SHORTWAVE LISTENING

with
Arthur Cushen, MBE

AWA pioneered broadcasting in Fiji

In Australia Amalgamated Wireless (Australasia) Ltd was one of the major organisations promoting medium and shortwave broadcasting in the 1930's, and their expansion extended to Fiji. Here they operated on both bands up to the 1950's, when control was taken over by the Fiji Broadcasting Commission.

As well as operating several mediumwave stations and shortwave stations in Sydney, Melbourne and Perth, AWA was of course, in the field of radio receiver production.

In 1937 signals from ZJV Suva on mediumwave 910kHz was heard and a year later VPD2, the shortwave outlet was heard on 9430kHz, carrying a common programme service.

In 1941 AWA announced a major project for Fiji with the installation of a 10kW transmitter, and test broadcasts were heard on 9535, 11,895 and 15,160kHz. But this project was cancelled due to the battle in the South Pacific and all shortwave transmissions were closed.

In 1943, a letter I received indicated that there would be no shortwave broad casting until after the war — though in the same year, low powered tests on 400W were conducted.

By 1948 the Fiji Broadcasting Commission had been formed as the programme provider. However, AWA still maintained the operation and ownership of the transmitters and in that year ZJV was moved to 920kHz.

By 1953 mediumwave ZJV, then on 930kHz had a new transmitter of 2kW and a 500W transmitter had been installed on behalf of the Fiji Broadcasting Commission. During the same year new studio buildings were under construction and the 500W transmitter was assigned the call VHR4 on 3980kHz.

In 1960, VHR5 was testing on 5980kHz with 250W and this test foreshadowed the ultimate use of higher powered transmitters. By 1962 the power had been raised to 10kW and the frequency of 4785kHz was being used. The last frequency to be used from Suva was 3935kHz.

Over the same period, a network of mediumwave stations had been built up. Although the FBC was in possession of a 10kW shortwave transmitter, this service was gradually phased out in preference to the use of the mediumwave network.

Over the years the staff of AWA in Suva and later the FBC, have been most appreciative of reception reports. Our files show many letters of appreciation for continuous reporting on some of their frequencies, and kindness in finding good, clear channels so that they could be widely heard throughout the South Pacific.

Fiji is another of the South Pacific countries that has closed its shortwave facilities and like Tonga and the Cook Islands at the moment, is a country which is no longer heard on the lower frequency bands.

Singapore's powerful voice

The opening of seven high powered shortwave transmitters in Singapore enables one to reflect on the history of broadcasting in that area.

It was on June 1, 1936 that the British Malayan Broadcasting Corporation commenced operation as a private commercial organisation. During the war years the facilities were used by the Japanese Forces and after the war it was interesting to receive the same verification card from Singapore that had been issued in the 1930's.

In 1952 the station moved and expanded its production and technical facilities and the four language services started independent transmission; by 1959 commercials had been added to the programmes. In 1975 the broadcasting headquarters were again moved and facilities upgraded.

The Shortwave Service has been upgraded with six 250kW and one 100kW transmitter. The Singapore Broadcasting Corporation is to be reorganised later this year into several separate companies, and they will be gradually privatised over a period of time. The SBC currently controls television and most radio services in Singapore.

The present schedule is Radio One (English) 2200 - 1800 on 6155, 9530; City Sounds (Mandarin) 2200 - 1800 on 6000, 9635; Warna Service (in Malay) 2045 - 1800 on 7250, 9590 (all 250kW); and the Tamil Service 2100 - 1800 on 7170 — this one using 100kW. The address for reception reports is SBC, Farrer Road, PO Box 60, Singapore 9128.

Costa Rican changes

This year Radio for Peace International celebrates seven years of shortwave broadcasting and has the unusual transmission pattern of some signals being on AM and the others on upper sideband. The present schedule is: 7375USB 0000 - 0800; 9375USB 0000 - 1200; 15030AM 24 hours; 21465USB 1200 - 0400UTC. The studios are located at Santa Ana, Costa Rica and the address is PO Box 88, Santa Ana.

The operation of Radio for Peace International was the outcome of a peace walk in 1984 and today the programmes mainly originate from the World Peace University, Oregon. Using a 30kW transmitter and a rotatable aerial system, this recent installation has greatly improved the reception of RFPI in various parts of the world and in the South Pacific the transmission on 9375 has been giving excellent reception around 0600UTC. ◆

AROUND THE WORLD

ANTARCTICA: Radio Arcangel San Gabriel is back on the air on 15,476kHz heard with an English announcement. The station can also be heard on 6030 at 2330UTC, but all programmes are in Spanish.

BELGIUM: Radio Flanders has been received at 1800UTC on 9925kHz with Dutch broadcasts. English broadcasts to Australia can be heard 0730 - 0800 on 5910kHz.

BOLIVIA: Radio San Miguel, Riberalta on 4922kHz opens at 0900 with a march, then a slogan and later has a frequency announcement which is followed by a music programme.

INDONESIA: RRI Jambi, 4927kHz has been heard with popular music at 1040. At 1100 there is an RRI Jambi announcement and at 1107 a Koran reading.

SAIPAN: KHBI is received with English to 1955, and this usual Christian Science Monitor Boston programme on 9355 announces as being beamed to New Zealand.

SLOVAKIA: Adventist World Radio is using two 250kW transmitters at Rimavsaka Sobotoa in the Republic of Slovakia. The best two frequencies are 9465kHz closing at 0500 and 7180kHz opening at 0700. The station requests reception reports to PO Box 100, 252 Darmstadt, Germany.

SOUTH AFRICA: Channel Africa Johannesburg lists part of their English schedule as: 0300 - 0500 5960, 9730; 0500 - 0600 11,745; 0500 - 0700 7275; 0600 - 0700 17,710 and 1000 - 1100 on 17,805.

USA: Voice of America Radio Marti on 9525 from Bethany is expected to move to 7340 and would be heard to 0600UTC on Sunday.

WINB Red Lion PA has dropped its old channel of 15,185kHz and with a new aerial system programmes are now beamed to Europe 1600 - 000 on 15,715kHz and to Mexico 0000 - 1100 on 11,950kHz. The station has been heard on 11,950 at 0800, and on 15,715 at 2100. Reports should be sent to PO Box 88, Red Lion, PA 17356, USA. ◆

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.

AUTOMOTIVE ELECTRONICS

with **MAJOR AL YOUNGER** (USAR, Ret.)

A handy test instrument for working on EFI

If an autotech purchased all of the specialised equipment and fixtures recommended by 'Detroit' in order to fix cars fitted with EFI, they would end up with a room full of equipment — leaving no room to work. Happily there are much smaller (and cheaper) solutions — such as the handheld DEFIA unit we look at this month. Made in Australia, it incorporates many of the functions you need for efficient servicing of EFI systems.

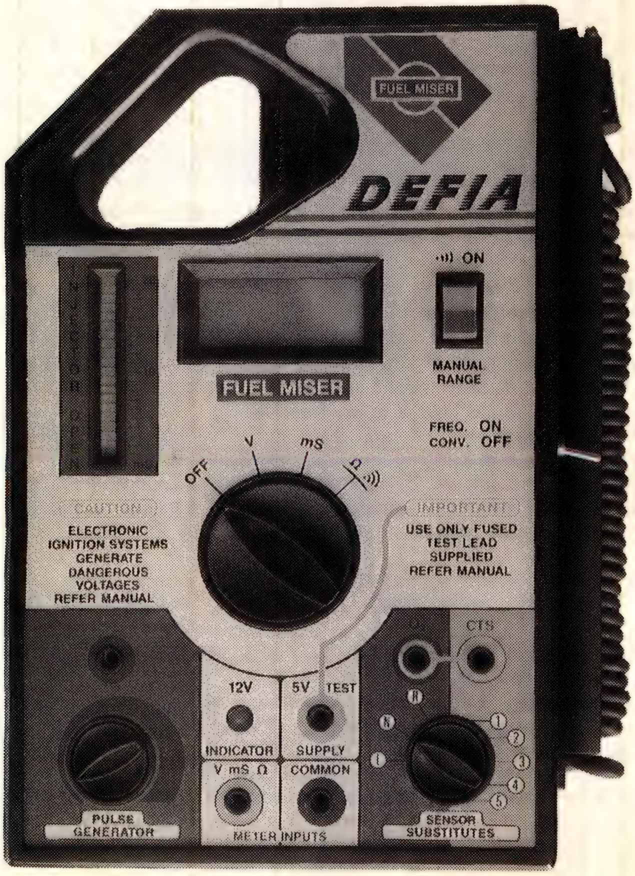
In North America, I carried a variety of 'hand-held' devices in my very large black bag. There was a digital voltmeter, an injector pulse-width checker, a frequency meter, a pulse injector, and simulators for both temperature and exhaust oxygen sensors. Can you imagine all this sitting on a car's fender? Obviously it would have been much nicer to have one multi-purpose instrument, and prior to my departure to Australia I purchased enough ICs to build such a device.

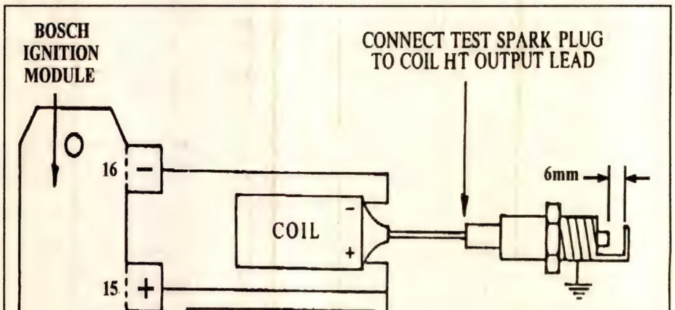
A month after I arrived in Sydney, though, I was talking to the director of a company specialising in automotive test equipment. When I told him I would like to build such a device, he promptly reached under his desk, pulled out a device and handed it to me — saying "You mean like this?" That was my introduction to the DEFIA (digital electronic fuel injection analyser), made by New Age Automotive Electronics (Fig.1).

The DEFIA has a 3.5-digit LCD display which can be used to measure DC volts and ohms (+/-0.5%), frequency and pulse width (+/-0.2%). It also has a bar graph display, reading from 1 - 20ms (milliseconds), a continuity test range, a 12V indicator, a source of +5V DC (+/-0.5%), an adjustable ignition pulse generator, an exhaust O_2 sensor simulator (with 'Rich', 'Normal' and 'Lean' output voltages), and a similar simulator for a coolant temperature sensor (CTS). It also comes with 14 standard accessories, including probes, lead sets and adaptors.

The most significant accessory is the manual. The manual tells you how to use the DEFIA, when making specific tests.

The built-in 5V supply is for testing sensors that require a five volts power

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COIL
–
+
15
+
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STATOR COIL
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+
–
BATTERY
IGNITION TRIGGER PULSE
7
V
RELUCTOR
APPLY PULSE GENERATOR, 12 AT THIS POINT WITH IGN' ON, AS DESCRIBED IN TEST PROCEDURE
3
REF
STATOR

Fig.2: To use the DEFIA's IP generator to test an ignition module, its output pulses are connected to the module's trigger pulse input pin. A test plug with a gap of 6mm is used to check the spark.

Fig.1 (left): The DEFIA, made by New Age Auto Electronics. It also provides EGO and CTS simulation signals.

source. On the other hand the 12V indicator LED may be used to check fault codes, power supply to injector solenoids and so on.

The exhaust oxygen sensor substitution facility is used by disconnecting the car's own O_2 sensor and connecting the DEFIA's O_2 output instead. Then while you also use the DEFIA to monitor the injection pulse width (IPW), the DEFIA's 'sensor substitute' switch is used to simulate rich (R), normal (N) and lean (L) conditions. If the ECM is responding correctly, it should act to correct the abnormal conditions — i.e., it should adjust the IPW to produce the opposite condition. So in the 'rich' position, the IPW should decrease (to 2ms or less), while in the 'lean' position it should increase. Note that the IPW is the amount of time, in milliseconds, that the injectors are open (turned on).

The CTS (coolant temperature sensor) substitution facility works in a broadly similar way, and again has a profound effect on IPW. In this case there are five switch positions, which cover the following situations:

1. Ford-Cold
2. Ford-Warm
3. Ford-Hot/Others-Cold
4. Others-Warm
5. Others-Hot

Switching into the Cold position should cause the ECM to increase the IPW, to produce a richer mixture. The Warm position should produce the normal IPW for an engine at operating temperature. The Hot (lean) position should decrease the IPW. (By the way, Hot indicates an *overheating* condition.

IP generator

The DEFIA's ignition pulse (IP) generator allows testing the ignition modules. The most common ignition failure is loss of IP, so having a source of substitute pulses lets you troubleshoot quickly and efficiently.

The IP generator is variable in terms of frequency, allowing you to produce the equivalent of different engine RPM settings — dependent upon the number of cylinders. The frequency range corresponds to these RPM ranges:

Four cylinder engine:	750-3000rpm
Six cylinder engine:	500-2000rpm
Eight cylinder engine:	400-1500rpm

To check an ignition system fully a spark plug is required. You can make your own set-up, or purchase a test spark plug. To test, you disconnect the sensor pickup lead from the ignition module and apply the DEFIA's IP output to the appropriate pin (pin 7 in Fig.2). If there's spark at the plug, then we know the module and the coil are both in good nick. If we had a problem before feeding in the substitute IP pulses, it must be a bad pickup.

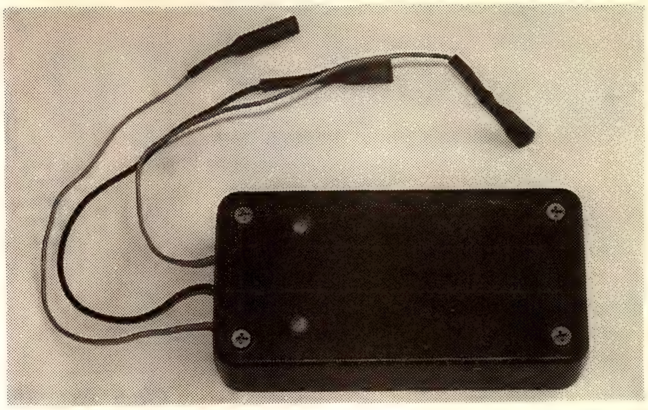


Fig.3: The simple TPS (throttle position sensor) tester made up by the author. It allows you to test a TPS in less than half a minute, instead of about 12 minutes...

To do this test in the car you must disable the fuel pump circuit. On most cars, just pull the fuel pump relay out.

That's about it. With the DEFIA you have not only a tester but also what I call a simulator, all built into one handy unit.

By the way, the DEFIA's owner manual goes much further than simply explaining how to use the DEFIA; it's also a good source of information on automotive systems testing. It even show how the autotech can test a power transistor, and also furnishes many diagrams and pin-outs for various EFI components. The manual was written from the autotech's viewpoint, with the focus on fixing a car. No commercials, just how to fix it. If you can read, you can understand this manual.

IPW diagnosis

The DEFIA works exceptionally well on AFC (air flow control) systems. These systems are programmed to provide a specific IPW or range, for a particular condition or conditions. A basic (fuel) injection quantity (BIQ) of 2 - 3.75ms is the design centre for these systems. The ECM monitors all conditions and modifies the BIQ, using negative and positive multiplication.

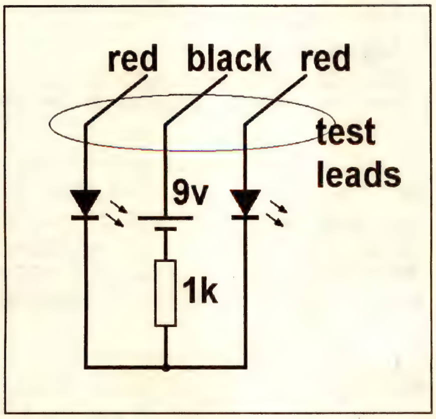


Fig.4: The schematic for the TPS tester. What could be simpler?

Most knowledgeable autotech's diagnose AFC systems by monitoring the IPW. That's why the DEFIA shows the IPW on the LCD display, and also provides an 'injector opening' bar-graph as well, to make monitoring of injector operation as easy as possible.

This is a very effective method of diagnosis and has been briefly covered in my article on Toyotas. I also intend to expand on it further, in a forthcoming article on Nissans.

DEFIA summary

The DEFIA was designed to satisfy the systems of the day (mostly the AFC type), on which it does a good job. However on some later systems, mainly Ford, a change in the method of fuel injector control affects IPW readings.

The earlier systems were voltage controlled, either ON or OFF. Thus, an instrument designed to read IPW could just monitor the basic injector solenoid voltage.

But the later Ford units use a rather different current control, reflecting software/hardware changes. The injectors are initially supplied with a 'turn-on' current (high), which immediately drops to a 'hold' current (low). This dramatically lowers the power required from the injector solenoid drivers. To me, this is a good example of a software/hardware solution to a problem.

Unfortunately the DEFIA reads the IPW as voltage and will not correctly read this kind of current-controlled injector circuit.

For its intended purpose, though, the DEFIA fills the bill. As I said earlier, it certainly replaces many items in my black bag. It's one of the few test devices on the market that was designed and built by an autotech, to solve everyday problems in fixing a car. For additional information on the DEFIA, call Leo on (02) 829 1666.

Simple TPS tester

Of course there's some testing tools that you can make yourself, at relatively low cost. I call these my 'special' tools.

To me, a special tool must save me time and be used often. If a procedure takes an hour the usual way, but only five minutes using a special tool, it may have value — although if the procedure concerned is only done once a year, that value might not justify making up the tool. So, my criteria for justifying a tool includes both time savings and usage.

I'm going to tell you how to duplicate one simple tool I've found very useful, a TPS (throttle position sensor) tester. But first, here's how I came to build it.

One day I had an appointment with the service manger at a Nissan dealership. While waiting, I observed an autotech checking the alignment of a TPS (throttle position sensor) on a 280-Z car. I glanced at my watch, and found it took him 12 minutes to complete the check.

That evening, I built a device that lets you do the same procedure in 20 seconds. It's pictured in Fig.3. I returned the next day and found the same autotech. I demonstrated the unit to him, and became $65.00 richer in 20 seconds. At the tea break, I took orders for three more.

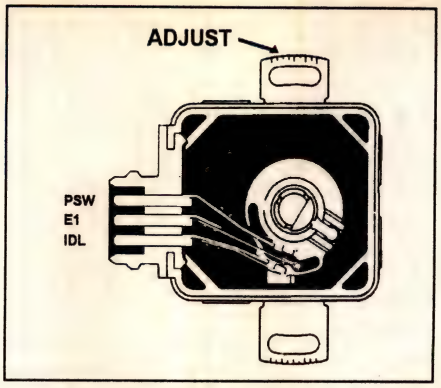


Fig.5: To test the TPS, hook the tester's black lead to the centre pin and its red leads to the two outer pins.

I still have the prototype unit pictured, and I know most of you *EA* readers will have the parts in your goodie box to build it. The schematic is shown in Fig.4, and as you can see it's really very simple indeed: a 9V battery, a 1k resistor and two LEDs, all housed in a plastic jiffy box fitted with three test leads.

Using it

To use the TPS testing tool, unplug the normal harness connector from the TPS sensor and attach the tester's leads to the connector pins. These are shown i Fig.5. The black lead goes to the centr (E1) pin; it doesn't matter which wa around you connect the red leads to th other two pins.

One LED should illuminate straigh away. Push (or pull) the throttle contro just slightly, and the LED should go off Then move the throttle to 65% or more and the *other* LED should illuminate.

Small adjustments can be made b loosening the TPS mounting screws an moving it, until the above tests give th correct responses. If this doesn't work the TPS must be faulty; a good technician can take the switch apart and fix it.

Books available

Finally, a reminder about the books I have written, which you might find interesting if you want to learn more.

The *Code Book* ($35.00) lists the ECM fault codes for all vehicles manufactured in Australia and most of the imports. The *Ford EEC-IV Electronic Engine Control* book ($60.00) covers all Fords with this system, including 'F' Series trucks. And lastly the *GM/Holden C3 System* book ($60.00) covers all vehicles fitted with the C3. Send your order with a cheque to Al Younger, PO Box 477, Double Bay, NSW 2028. ◆

NOTES & ERRATA

Plasma Display (January 1994):
The parts list for this project was inadvertently omitted when the article was being assembled. The parts list for this project is now shown below, and our apologies are offered to those readers who were disappointed when the article was originally published.

PC-driven 68705 Programmer (January 1994):
The author has advised that a track is missing from the pattern for the smaller PCB — that for the power supply, given at the top of page 89. The missing track should link the 'upper' centre pin of switch SW1, at the top of the board (just to the left of centre), with the pin to its left — the one connecting to fuse F1. In other words, the two upper left hand pins of SW1 should be linked together, in exactly the same manner as the two lower left hand pins. Existing boards can be fixed by soldering a short wire link between the two switch pins.

Versatile 40V/3A Lab Power Supply (December 1993 and January 1994):
There is an error on the PCB which leaves IC4A's step compensation network (C16 and R36) out of circuit, and can cause the supply to become unstable when the current limiting stage is active — such as during a 'set current' operation. To correct this, first remove C16 and bend one leg so that it can lie on the component side of the board, then re-install the capacitor and solder the leg to one end of R35 as shown in the diagram.

If you encounter any further instability after this modification, try disconnecting the bypass capacitor C3 which is wired to the terminals of the voltage potentiometer RV1.

PLASMA DISPLAY PARTS LIST

Resistors

All 1/4W, 5% unless otherwise stated:

R1	2.2k
R2	10k
R3	100 ohm
R4,5	10 ohm 1W
R6	15 ohm 1W

Capacitors

C1	470uF 25V electrolytic
C2	10nF polyester
C3	3.3nF ceramic

Semiconductors

Q1	BUZ71 N-channel MOSFET
Q2	2SD1554 NPN power
IC1	555 timer

Miscellaneous

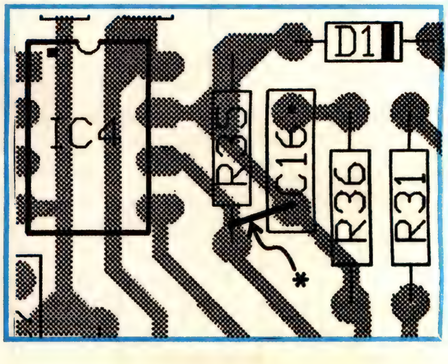
PCB 33mm x 130mm coded OEplasma; step-down coupling transformer; line-output transformer; optional 8-pin IC socket; heatsink to suit Q2; incandescent light globe; suitable glass jar; silicone glue; connecting wire; 12V 1A DC supply.

A kit of parts for this project is available from:

Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985
Postal address (mail orders):
PO Box 89, Oatley West NSW 2223.

PCB, all on-board components, line-output transformer	$25
Sodium vapour lamp (personal shoppers only)	$15
Post and pack charges	$4

This project is copyright to Oatley Electronics.



Special Mini Project:

SOLAR-POWERED GARDEN LIGHT

Here is a project you can put together in an afternoon, which will provide brilliant illumination for the gardens and lawns around your house. It's a solar powered light which uses no batteries at all, drawing its total power from the rays of the sun.

by TOM MOFFAT

This light will discourage any burglars that might be lurking about, and it will prevent birds, dogs, and possums from eating your valuable flowers. Tropical plants will benefit especially, since experts say they tend to grow taller and stronger in the presence of light.

With the price of solar cells beginning to come down now, many solar powered light projects are being described in the magazines. Most of them rely on a rechargeable battery of some kind to store collected energy, which is then released into the light later.

Because of the low effluency of rechargeable batteries such as NiCad and lead-acid cells, and the weak output of older solar cell designs, it has previously been necessary to charge the battery for many hours in order to get only a few hours use from the light.

This design uses multiple solar cells to drive the light directly via a very effluent regulator, so that the light provides strong illumination at the same time the electrical energy is being collected from the sun. There is no need at all for a rechargeable battery.

Construction

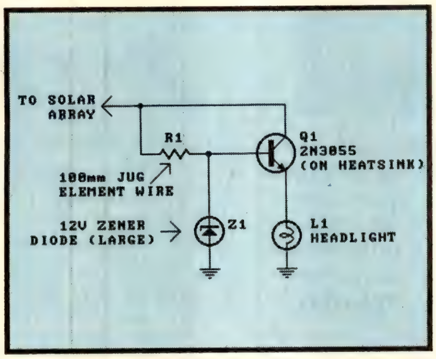
The light itself is a sealed-beam car headlight which will run directly from the 12 volts DC delivered by the regulator, without any additional transformers. You can obtain these car headlights fairly cheaply at car wrecking yards, and most have plenty of life left in them.

While you're at it you may as well get a housing for the light from the wrecker's too. If the headlight comes from an older car, the whole mudguard assembly may be removable, so perhaps you can purchase the mudguard and the headlight as a unit — eliminating the necessity to build some kind of enclosure to shelter the light from the rain. The headlight, and its mudguard, can later be mounted at the top of a pole to provide a wide area of illumination for your garden.

Still at the wrecker's, you will need to purchase a car roof on which to mount the solar cells. Ask the wrecking yard proprietor to cut the roof loose from the rest of the car at the four window pillars. A cutting torch will do the job easily.

The car roof is necessary because intensive studies by automotive engineers have shown that solar cells work most efficiently when mounted on a car roof. This was proved in last year's solar powered car race through Central Australia in which all the solar cells were mounted on car roofs. Because of this one of the cars won.

You can get the solar cells themselves from almost any electronics retailer. Try to get the type that are bound together to produce a 12 volt output under load. Purchase enough of these units to cover the entire car roof. You can attach the solar panels to the car roof with something like vinyl tile adhesive. When the glue has set, solder the outputs of all the panels in parallel. You may need a 200-watt plumber's soldering iron to get the wires hot enough. They will eventually connect to your regurgitator.



When installing the car roof in your garden, make sure it is right out in the open — that is, not shaded by any trees. You can test this (make sure it's on a bright day) by lifting the car roof slightly above the ground before securing it in its final position. If it casts a shadow, then it is out in the sun.

Now briefly place the car roof aside while you pour a concrete slab. Once it is set you can use Dyna-bolts at each corner to secure the car roof in place, preventing it from blowing around in the wind.

Ensure that there is the minimum possible distance between the car roof and the headlight to minimize losses in the wiring. In fact you may prefer to install the car roof directly under the light so output from the light adds to the solar energy, increasing the effluency of the system even further.

The regulator

The voltage from solar cells tends to soar in strong light, sometimes reaching as much as 25 volts on a really bright day. This is over twice what is needed by the 12 volt car headlight, so some means must be used to reduce the voltage to a more manageable level.

This is done with a circuit called a grunt regulator, employing a familiar 2N3055 transistor. This transistor almost handles the current needed by the car headlight, and as a bonus it provides some extra heat on a cold day.

As you can see from the diagram, the regulator circuit is very simple. A zener diode connected to the base of the transistor sets the regulated voltage. Because of the high effluency of the bank of solar cells and the current requirements of the car headlight, plenty of current must be fed to the zener and the base of the transistor. A piece of broken jug element may be useful here as a base resistor.

Because of the current flow the transistor will become quite warm, and a heatsink is required. A good place to mount the transistor is on the mudguard on top of the pole, where it can be cooled by prevailing winds. You may need to cut some slots in the mudguard to increase air flow. Connect the emitter of the transistor to the car headlight as shown in the diagram, using a short length of copper tubing. Connect your solar collector to the transistor collector, using red and black welding cable.

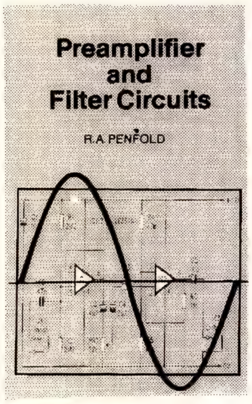
Testing

This is a very simple procedure. Wait until a very bright sunny day comes along, and then run outside and look up at your solar powered light. It should be shining brightly. If it isn't, you may have mistaken night for day. Check again.

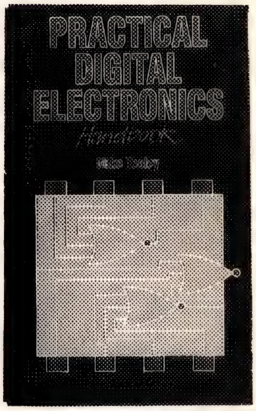
As well it may be the wrong time of the year, since this particular design only works at its best during the very early part of April. ❖

Electronics Australia

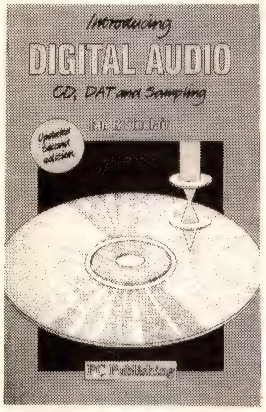
BOOKSHOP



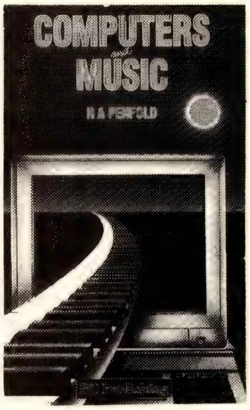
Preamplifier and Filter Circuits
This book provides circuits and background information for a range of preamplifiers, plus time controls, filters and mixers. The circuits described are simple and previous experience of electronic project construction is not needed.
CODE: BP 3090 PRICE: $11.00



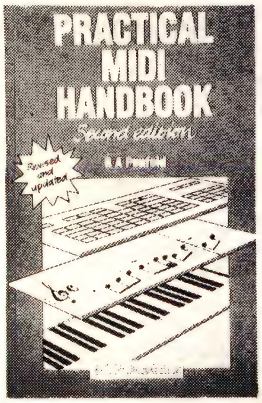
Practical Digitial Electronics Handbook
This book introduces digital circuits, logic gates, bistables and timers as well as microprocessers, memory and input/output devices. It will prove invaluable to anyone involved with the design, manufacture or servicing of digital circuitry.
CODE: PC 1004 PRICE: $22.95



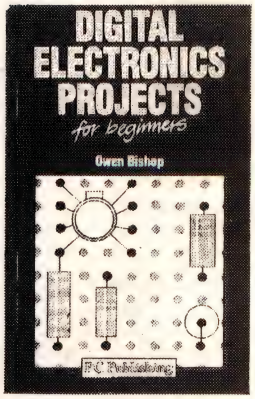
Introducing Digital Audio, CD, Dat and Sampling. - Second Edition:
This book bridges the gap for the technician and enthusiasts who have worked with audio circuits. It includes oversampling methods and bitstream techniques and technical terms.
CODE: PC 1007 PRICE: $22.95



Computers and Music - An Introduction:
This book explains how to simply set up your own computer music studio. It covers the basics of computing, running applications programs, wiring up a MIDI system plus everything about hardware and the programs.
CODE: PC 1006 PRICE: $27.95

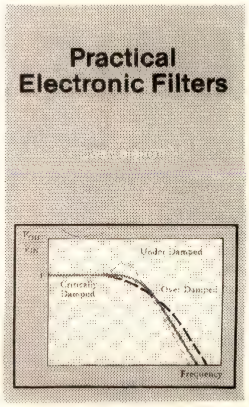


Practical MIDI Handbook
Refers to the powerful capabilities of MIDI and how to exploit it, with no knowledge of electronics or computing. It reviews the latest developments in MIDI covering keyboards, drum machines, sequences, mixers, guitars etc.
CODE: PC 1002 PRICE: $22.95

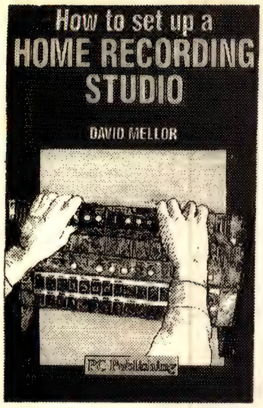


Digital Electronic Projects for beginners
This book provides simple, yet detailed instruction on practical projects. Covering instrumentation to home security plus circuit diagrams, this reference book also offers 'fun' projects for newcomers to electronic construction.
CODE: PC 1011 PRICE: $19.95

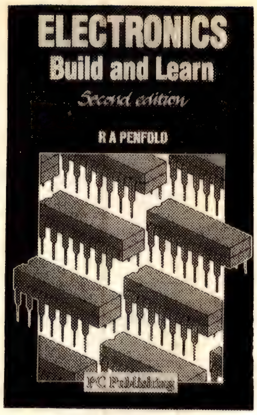
Synthesizers for Musicians
Written especially for musicians, this book explains how to get the best from your synthesizer or sampler. If you want to go beyond using the factory presets or the random poking of buttons, then this is the book for you.
CODE: PC 1003 PRICE: $19.95



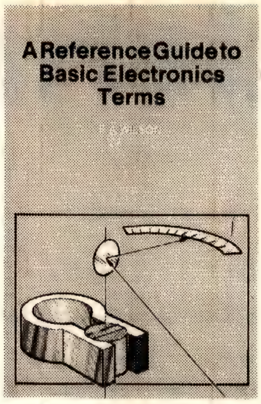
Practical Electronic Filters
Practical Electronic Filters explains in a simple form, the understanding of how to work a filter. It presents projects to apply in and around the home, including diagrams that are suited to the beginner and a more advanced constructor.
CODE: BP 2990 PRICE: $13.00



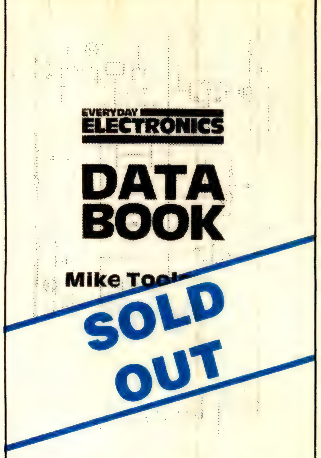
How to set up a home Recording Studio
If you have a studio at home or are about to set one up, this book is for you! It describes the setting up of an 8 to 16 track studio with an outline of the musical and recording gear needed.
CODE: PC 1009 PRICE: $22.95



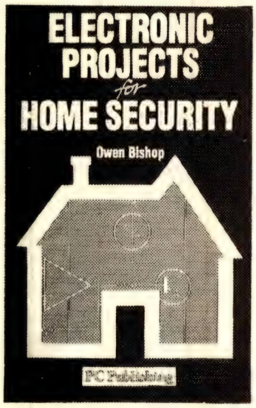
Electronics - Build and Learn
This book is the perfect balance of theory & practice. It introduces common electronic components and how they are built into useful circuits. An essential for the beginner, providing practical tests and experiments.
CODE: PC 1008 PRICE: $19.95



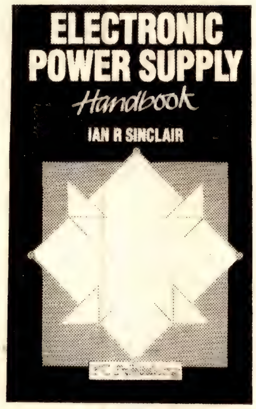
A Reference guide to Basic Electronic Terms
A comprehensive A to Z guide of electronic terms. This book chooses and explains some of the more important fundamental terms (over 700), making the explanations easy to understand and avoiding high level mathematics.
CODE: BP 2860 PRICE: $16.00



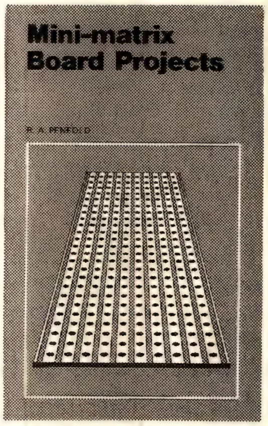
Everyday Electronics Data Book
This book is an invaluable source of information of everyday relevance in the world of electronics. A must for everyone involved on electronics who wants to put theory into practice.
CODE: PC 1012 PRICE: $27.95



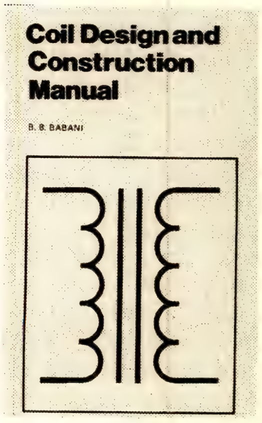
Electronic Projects for Home Security
This book deals with the many aspects of home-security and how to construct your own security system. It covers the latest in technology, whilst remaining simple and reliable in its instruction.
CODE: PC 1010 PRICE: $22.95



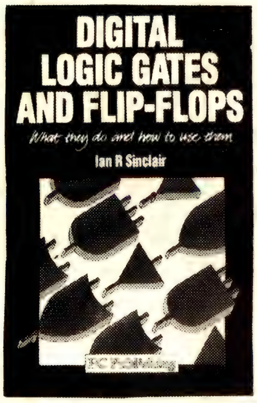
Electronic Power Supply Handbook
This book covers the topic of electronic power supplies, including batteries, simple AC supplies, switch-mode supplies and inverters. Subjects dealt in detail are devices, their operating principles and typical circuits.
CODE: PC 1001 PRICE: $23.95



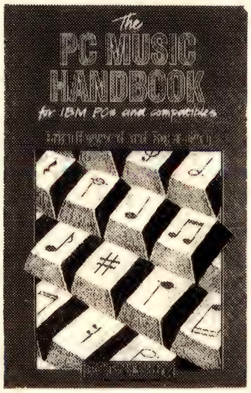
Mini Matrix Board Projects
This book provides you with 20 useful and interesting circuits, all of which can be used on a mini matrix board, which is just 24 holes by 10 copper strips.
CODE: BP 9900 PRICE: $6.50



Coil Design and Construction Manual
A unique book for both the professional and home constructor on 'How to Make' your own R.F., I.F., Audio and Power coils, chokes and transformers etc.
CODE: BP 1600 PRICE: $6.50


DIGITAL LOGIC GATES AND FLIP-FLOPS
What they do and how to use them
Ian R Sinclair
PC Publishing

Digital Logic Gates and Flip-Flop
Intended for enthusiasts, this book aims to provide a firm understanding of gates and flip-flops thoroughly and from the beginning. It is for the user who wants to know more than a few rules of thumb about digital circuits.
CODE: PC 1013 PRICE: $26.95

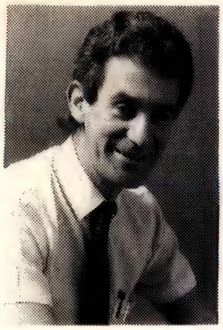


The PC Music Handbook
This book takes the reader through the creative possibilities of the personal computer. Full of practical tips on equipment plus explanation of sequencing, sampling and notation.
CODE: PC 1005 PRICE: $27.95

HOW TO ORDER

To order, simply fill in the coupon, remembering to include the code numbers and $5.00 postage and handling. If the coupon is missing, write down the names, code numbers and prices of the books you require. Include your name, address, phone number, plus cheque, money order or credit card details (card type, card number, expiry date and signature) and send it all to Federal Publishing, Reply Paid No. 3, PO Box 199, Alexandria, NSW 2015.

Please allow at least 40 days for delivery, and please sign all orders.



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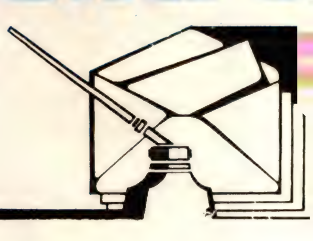


Conducted by Peter Phillips

Video colour organs, PCB making and bootstrapping

There's quite a few excellent reader ideas this month, along with the usual (and unusual) question and answers about projects and other matters.

Have you ever muttered to yourself "It can't work, so why does it?" I'm prompted to write this following some recent experiences with EFTPOS transactions. I've found lately that some EFTPOS machines have difficulty reading the magnetic strip of my plastic card. Sometimes the shopkeeper would give up and I'd have to pay by cash or credit card, rather than transfer funds from my bank account.

That is, until recently when I learnt how to get around the problem. I was amazed at the simplicity of the solution — and I've yet to figure out how, or why it works. Basically, the offending card is placed in a thin plastic bag, with the magnetic strip at the bottom of the bag. The card in its bag is then 'swiped' in the usual way, and presto! up comes the acceptance from the computer.

I've seen this work three times now, in different machines that previously wouldn't accept my card. In the first case when the operator showed me, and from then on when I explained it to disbelieving shopkeepers. And it always works first time. But why?

Obviously the plastic bag puts extra distance between the read head in the EFTPOS machine and the magnetic strip on the card. To me, this should make reading the card even more difficult. Imagine putting a layer of thin plastic between a computer disk and the head of the disk-drive. It would never work! Or would it? As Pascal said in 1670, "It is not certain that everything is uncertain". Or as *I* say, in 1994: The certainty is that there will always be one more thing I don't understand!

Karaoke project

Our first letter, though nicely worded, has a slight edge of distrust...

I am writing about the Karaoke Adapter described in EA in November 1991. I bought a kit for this project from a reputable supplier and have constructed it properly. However, the completed unit doesn't work as a Karaoke box, but rather like a volume control. That is, the NULL function suppresses everything, not just the singer.

I have thoroughly checked all components, wiring and have tested the box with audio output from video (single output) and hifi (dual outputs) using many different music tapes, including some Karaoke video tapes. The result is still the same. My questions are:

1. *From the circuit diagram, do you really think the project should work as described?*
2. *If so, what do you think is causing my problem?*
3. *How can I be sure that a kit bought from an electronics store will work as described?*
4. *If I need some advice on a particular project, how can I contact the author?* (D.P., Riverview Qld).

This project comes from a design originally published in 1982, called a Vocal Canceller, because at the time the term Karaoke was still to be popularised. The circuit is extremely simple and relies on the voice being recorded equally on the left and right channels of a stereo recording. By summing the outputs (effectively) of the normal and inverted signals, the common mode signals are cancelled, leaving the music without the voice.

So do I think it will work? Yes, most definitely, providing the voice is a common mode signal. So D.P., why is your project not working?

Here I could go through my usual patter of soldering errors, wrongly placed components, incorrect wiring and faulty components.

However you say you have checke all these things, so I won't. Instead, wonder whether the signal source is th problem. A simple test is to connec both inputs to the same signal sourc and to compare the output level to tha when the box is set to OFF or NORMAL. You should be able to operate th NULL control to give a much reduce volume level compared to normal. If so the circuit is working. If not, well...

If the circuit works as I'v described, then you must be feeding th wrong type of signal to the unit (a completely mono signal, for example — which WILL result in the kind of actio you describe).

We have no errata on the project, an you can be sure the design wa thoroughly tested, as it was built by *EA*'s own technical editor Rob Evans.

To answer your other queries, we have no control over the quality of kits, but we don't know of any cases where a parts supplier has modified a design without telling us. I think you can safely purchase a kit from any of the main suppliers and know the parts and PCB are as specified by the designer. The quality of the parts may vary, but in simple designs like the Karaoke adaptor this is unlikely to be a problem.

Concerning contact with the designer, this is not a problem for in-house designs, such as this one. See the last page of the magazine for details. Other projects are often copyrighted to the designer, whose address is usually included at the end of the article anyway.

FM converters

Next, here's a simple enquiry that begs an equally simple answer:

I recently bought from DSE a kit for the six metre band FM receiver described in January 1990. The article *included with the kit said the design could be used with future converters for other bands.*

Has EA produced other converters that can be used with this receiver, and if so, where do I purchase kits of parts? (G.H., Elermore Vale NSW).

There have been two converters designed for this receiver, one for the 144 - 148MHz band in May 1990 and another for the 420 - 450MHz band in June 1990. The converters were developed by the designer of the original receiver, so compatibility is assured. Regarding kits, I suggest you contact DSE or other suppliers.

Measuring AC millivolts

The next letter wants information about making PCBs, and whether we've ever designed a signal tracer...

I have two queries you may be able to help me with. The first is about making your own printed circuit boards. Have you ever published anything about this subject?

Secondly, when my electronic organ developed a fault recently, I found it would have been a lot easier to faultfind if I had a VTVM to trace the audio, which in parts of the circuit is down to a few millivolts. There used to be a very economical VTVM available from Heathkit, but is there a solid-state version available these days? I notice that even the best multimeters cannot read lower than 200mV, which is not sensitive enough for this purpose. (J.M., Aldinga Beach, SA).

The topic of printed circuit board design and making has cropped up many times over the years. The first article goes back to November 1972, with another in December 1977. More recently, an article called 'PCB Making' was published in October 1987, and an etching tank for PCBs was described in May 1989. We've also had reviews on most of the PCB design software packages.

Regular readers will know this column has recently featured a few PCB making techniques, and to prove it, there's more this month. So, J.M., there's no shortage of material.

You mention a VTVM (vacuum tube voltmeter for those who don't know what we're talking about) as a means of measuring low value AC signals. I doubt whether this or any AC voltmeter is the best equipment to use when tracing audio signals, as even if the meter can show a reading, there's no way of knowing if the signal is audio or noise. A better way, assuming you don't have an oscilloscope, is to use a signal tracer.

We described an audio signal tracer in August 1985, but you can make any audio amplifier into a suitable tracer. After all, that's all a signal tracer is: an audio amplifier with a probe. Incidentally, even though a DMM might be marked as having a scale for 200mV AC, the meter will read as low as 1mV.

Power amp problems

Staying with audio problems, the next letter is from a 16 year old reader with an enquiry about an ETI project and also a 2m transceiver.

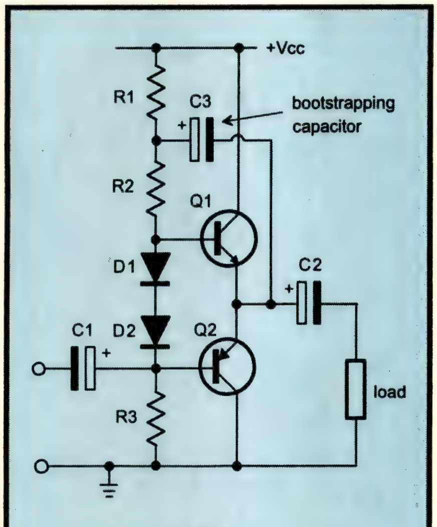


Fig.1

Firstly, congratulations on a fine magazine. I constantly refer to back issues. My first question is, why don't you develop a less expensive design for a 2m transceiver? I can't afford the few hundred dollars for the most recent one.

My second question is about the ETI-1430 50W power amplifier module. I have built quite a few of these and have found them to be of excellent quality. I have a problem with one I recently built in that the PNP output transistor gets much hotter than the NPN output transistor. This is especially true at low listening levels. I have replaced all small transistors and the diodes.

When designing a circuit, what rule of thumb should you use to determine the power rating of a resistor? Should it be cold, warm, hot or too hot to touch? And finally, what is bootstrapping in reference to amplifier design? (J.P., Teralba NSW).

The 2m transceiver you refer to is probably the DSE designed unit described over January to April 1991. Unfortunately to get the sort of performance readers expect these days means the unit will not be budget priced. Perhaps you might consider the 2m receiver referred to previously in this column, and also a simple crystal-locked FM transmitter we described in November 1989. A 2m power amplifier was described in ETI in January 1979 which might also be useful with the transmitter.

Regarding the power amplifier module, I suggest you check the quiescent voltage at the junction of the output transistors. This should be zero. My reasoning for this is simple: because these transistors are effectively in series (for quiescent current purposes), they therefore have the same value of current flowing through them. If one is getting hotter than the other, it must have a different voltage across it, as power dissipation (heat) equals voltage times current.

If in fact the quiescent voltage is zero, and both transistors have the same voltage drop (35V) across them, the problem must be in the heatsinking arrangement. Also check the value of, or the voltage drop across, the emitter resistors.

Regarding heat dissipation, I work by the rule that the hotter the component, the more likely it, or its connections are to fail.

The problem isn't so much how hot the component is, but rather the heating and cooling cycle. As a component heats or cools, it undergoes mechanical stress, and circuit designers usually include quite substantial connections to such a component.

Anyone who has ever felt the temperature of a '486 DX microprocessor in an IBM computer will know that 'too hot to touch' is considered suitable by the designers.

As far as I'm concerned, it should be possible to touch a component without leaving skin on its surface. Ideally, you should be able to leave your hand on the component without discomfort. However, given suitable design, some components *can* run at quite high temperatures. But this really is the exception.

Bootstrapping refers to a form of positive feedback around a power amplifier, to help it function. From your supplied circuit of the ETI power amp, I can't see any bootstrapping. A simple bootstrapping circuit is shown in Fig.1. The output signal is AC coupled via C3 back to the biasing circuit supplying the output transistors.

The effect of this feedback is to make the AC voltage swing at the top end of R2 almost the same as that at its bottom end, and because of this R2 draws almost no AC current — behaving as if it were a much higher value resistor, and presenting much less loading to the stage which is driving the circuit, via C1. This usually allows the driver stage to achieve a much larger voltage swing than without the bootstrapping, and the amplifier can achieve a higher undistorted output.

The term 'bootstrap' comes from the improbable concept of lifting yourself off the ground by 'pulling on your bootstraps'.

PCB making

As promised before, here's some more on PCB making. It seems there's no shortage of amazing ideas on simplifying the process. The first letter concerns another method of transferring photocopier toner to PCB laminate. I've heard this now from a few sources, though I've yet to try it:

I was interested to read your comments in the December 1993 issue about making PCBs using a photocopier. This process has been around for some time and I have used it successfully for a number of years using overhead transparency sheets. My method for removing the sheet after ironing is simple and effective. Just put the board in a deep-freezer for two or three minutes while it's still hot. The sheet literally peels off the tracks. The suggestion of using the paper base is intriguing and next time I'll try it.

A problem no one has described is the image produced by a photocopier. Most copiers don't produce an exact 1:1 copy, which can be a problem with IC sockets having more than 16 pins. My solution is to blow up the artwork to 195% and experiment with a reduced copy of 51% or so until the exact size is reached, so the IC will match the holes.

I've also made a double-sided board using the toner transfer process. The procedure is:

1. *Put the track design on side 1 and paint the other side with nail polish. Then etch side 1.*
2. *Remove the nail polish on side 2 and transfer the track design using three register holes.*
3. *Paint the previously etched side with nail polish (obviously very important).*
4. *Etch side 2, then remove the polish from side 1 and clean up the board.* (L.L., Port Lincoln SA).

Thanks for these ideas, L.L. Incidentally, the rest of your letter about parts availability follows later. I was alerted to the idea of using photocopy transparencies rather than paper by another experimenter, and it seems to be an excellent idea.

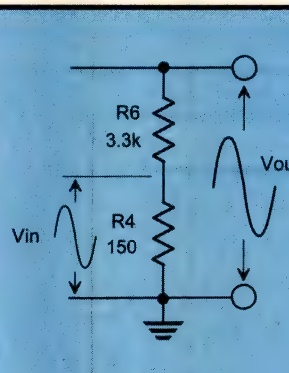
Apparently you need a piece of paper between the iron and the transparency during the transfer process. The problem with paper is the toner is absorbed, while plastic sheet is likely to be less absorbent, leaving more toner for transferring to the copper. I'm anxious to try the method.

The next letter describes a method that has to be as direct as you can get...

The idea of using a photocopy direct onto a PCB will no doubt revolutionise home PCB manufacture as you suggested in December. The article puts me in mind of a technique I used when doing research some years ago. I used one of the circuit drawing programs on an IBM (Protel or Fastwire) and then drew the design using a plotter driven from the computer.

Instead of drawing the design onto paper and going through the UV process, I used a special ink in the plotter pens and drew directly onto the copper. The ink was the stuff they use to mark the plastic ear tags in cattle (I can't remember its name now). It can be bought cheaply from agricultural supply places, and it doesn't clog the pens.

Not many hobbyists have a plotter, so the technique may not be of use to everyone and for all I know it's common knowledge. Still it was new then and saved a lot of time. (C.H., Exmout
WA).



$$I_{R6} = I_{R4} = \frac{V_{in}}{R_4}$$

$$V_{R6} = I_{R6} \times R_6 = \frac{V_{in} \times R_6}{R_4}$$

V_{out} = sum of the voltages across R_4 and R_6

$$V_{out} = V_{in} + \frac{V_{in} \times R_6}{R_4}$$

dividing both sides by V_{in}

$$\frac{V_{out}}{V_{in}} = \frac{R_6}{R_4} + 1$$

voltage gain $\left(\frac{V_{out}}{V_{in}}\right) = \frac{3300}{150} + 1 = 23$

Fig.2

As I said, there's no shortage of idea
Cattle ear-tag ink in a plotter pen seen almost bizarre, and who would hav thought of it. Still it obviously worke and for those with a plotter, there *another* way open to you to make PCB more easily.

Finally here's another way...

In the January edition you describe a method for producing negativ artwork for PCBs, a method that ap pears to be a monumental waste of tim We distribute a low-cost, precoate positive resist PCB that was featured i EA May 1990, page 139.

There is no need to produce an inter negative with a laser printer. Plottin directly to a transparency gives excel lent results. The artwork is laid on th pre-sensitised surface and exposed to UV source. Development doesn't requir any photographic chemicals. It's single stage dip in a sodium metasilicat solution (commonly used as a deter gent), which is available in pre-packe 50g sachets.

The board is then ready for etching The remaining coating acts as solderable lacquer, so there's no need to strip it off. The laminate is available in single-sided phenolic, or single an double-sided fibreglass. (Kevin Dare Component Division, Computronics Perth).

The address to get further information, or to purchase the product Kevin has described is: Computronics, 31 Kensington St, East Perth, 6004 WA; phone (09) 221 2121, fax (09) 325 6686.

To give you a guide, a piece of pre-sensitised single-sided fibreglass PCB measuring 100 x 150mm costs $4.55. The developer is $1.99 for a 50g sachet. These prices are less sales tax.

Video musicolour

Now here's an idea that sounds not only very feasible, but quite entertaining...

Your competitor presented a TV colour bar generator in November 1991. This project uses a TEA2000 colour encoder IC to display the colours on the screen. The chip accepts separate (TTL?) inputs for red, green and blue.

Surely it could be set up so that each input will produce a full TV screen of the selected colour. That is, energise the red input and get a red display. If the red and green inputs are active, you get a yellow screen and so on.

But the magic of this is to connect the usual three channel musicolour signals (R, G and B) to the RGB inputs of the

TEA2000 IC. Here you'll get low tones giving a red screen, medium giving a green screen and high tones producing blue. Mixtures of tones will produce all kinds of colours.

Perhaps you could build this as a separate project or as an enhanced Musicolour with all the usual chaser features, plus video musicolour. Or maybe as an enhanced colour test generator with musicolour inputs. (J.S., Greystanes NSW).

Thanks for these ideas, J.S. I can see this being quite popular, as it gets away from the dangerous part of the Musicolour design, the 240V lamp switching circuit. Discos could even use a projection TV for larger displays. One to definitely look into!

2TM reception

The next letter offers advice about a receiver design able to pick up the distant 2TM. This letter is in response to reader J.M. (Windale, NSW) who wrote in January seeking information about the best type of receiver for DX'ing.

Having been involved in the design of a wide range of receivers for domestic, commercial and defence applications as well as many types of communications systems, I may be able to offer a few comments which might help to steer J.M. in the right direction.

First of all, even with three TRF stages, he will find it rather difficult to keep adjacent channel interference down to an acceptable level at nighttime with the ratio between wanted and unwanted frequencies of only 0.7%. In the case of a superhet receiver with an IF of 455kHz, this ratio is increased to nearly 2%, making the situation much better. If J.M. can get an early 1930's superhet with an IF of 175kHz, the ratio becomes a bit over 5%, improving the situation yet again.

With regard to aerials, although a gain of 20dBi (less 3dB for the far end termination) is quite possible with a well-designed rhombic in the HF band, such an aerial needs real estate about the size of a coastal dairy farm. By far the most satisfactory solution for distant MF reception is a high quality rotatable ferrite rod as the first tuned circuit of the receiver.

In practice, I find that in spite of the high electrical noise in the Sydney suburban area, I can get very good reception from 2TM at night with a high quality set using just such an aerial, with a tuned RF stage and a 455kHz IF. Some treble cut above 3.5kHz is helpful. Of course, when deep fades occur, the increase in receiver sensitivity with reduced AGC brings in some 'monkey-chatter' from the adjacent channels. While that effect might be reduced with crystal filters in the IF channel and accurate tuning of the local oscillator, the only real solution is diversity reception along with its inherent complexity.

The best receiver I have at present for difficult reception conditions is a National Panasonic six band Model RF-1180B, now about 14 years old. (W.M., Leumeah NSW).

So much for my suggestions of a TRF set and a rhombic aerial. Thanks W.M., I'm sure J.M. will be grateful for this information. A tuned ferrite antenna seems a most practical way of going about it, and one that shouldn't be too hard to implement.

Component choice

Here's the rest of L.L.'s letter as promised...

It seems every project I undertake has supply problems with ICs. This may not be a problem for those who buy kits, but because I prefer to use bits and pieces from stock it is always a problem.

Take for instance the spectrum analyser described in September-October 1992. I decided to build this project last June, but the receiver IC (NE605N) was unprocurable in South Australia. In desperation I rang a kit supplier from interstate, and finally obtained this IC.

I also had problems with the MC145152 used in your DSB rig (July 1993). The same tale applied except I did find one firm prepared to get the two chips for me. I find it incredible that a basic chip like this is almost unprocurable.

I often wonder what happens to projects when they need repairing. I guess there are many projects sitting on the shelf because the parts can't be found.

Can I plead with your designers to use chips that are regularly available from popular parts suppliers. (L.L.)

Yours is not the first letter I've had (and used in this column) about hard to get ICs. I don't know what the answer is. If we limit ourselves to 'garden variety' components, we can only produce simple, boring projects. (Not another power supply, amplifier or battery charger!)

When we take on contemporary ICs in the belief they will be around for a while, we run the risk of producing a project with parts that may be unobtainable before long... Still, we take your point L.L.

What??

Here's a question that will suit those who like mathematical puzzles. It has been sent to me by Peter McEvoy, who describes himself as an avid reader. Peter has adapted the question from a less electronic version. Peter writes...

As often happens, my latest project needed just one more resistor of a certain low ohms value to be completed. So I raced down to a large electronic parts emporium, getting there just before closing time. The emporium had just had a monster stocktaking sale, so there wasn't much left. "How many resistor values have you got left?" I asked the sales assistant. "Only three", he replied. "What are their values?" I queried. "Multiplied together they give 36; added up they equal the number of the aisle in which resistors are kept."

Thinking 'this fellow is rather strange', I replied, "If that's all I need to know I'll trot on down and find them". He then said a most unusual thing: "You also need to know that the highest resistor value may prove useless for your project". By now, as you can imagine, I was wondering about this sales assistant!

So, what are the resistor values left and what is the aisle number?

Answer to the March What?

The voltage gain is about 23. Because the amplifier has voltage derived negative feedback, the gain is virtually determined by resistors R4 and R6.

The equivalent circuit of the input-output signal path is shown in Fig.2. Because a capacitor is a short-circuit to AC, R4 is effectively connected to earth. R6 connects from the output terminal in series with R4. By emitter follower action, the AC voltage across R4 is virtually equal to the input voltage Vin. This is an approximation, but a reasonable one in this case.

The mathematical solution to find the gain is shown with Fig.2. Notice that it is based entirely on Ohm's law, giving an equation where gain = (R6/R4) + 1.

The second part of the question is far less mathematical. If there is no load connected to the circuit, R6 *can* be connected to the output terminal.

However, if a resistive load is now connected to the amplifier, it will affect the DC operating conditions of the whole amplifier. This is because the series combination of R6 and the load becomes another DC path for the emitter circuit of Q1. You either saw it quickly or not! ❖

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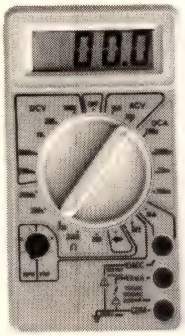
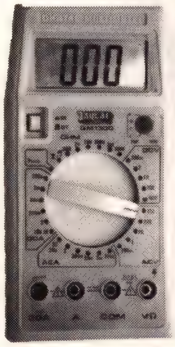
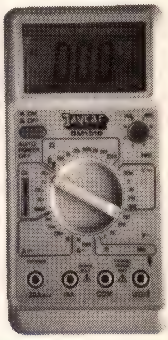

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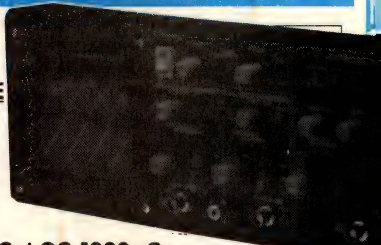
Note: Probes if purchased separately are $39.50 ea.



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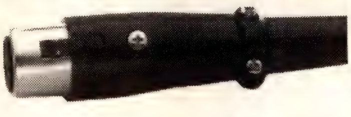

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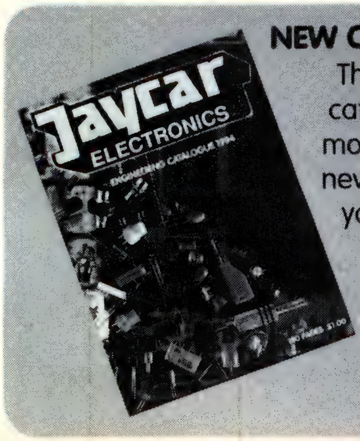

The Jaycar 1994 180 page catalogue was released last month. It includes hunderds of new and interesting products. If you haven't got your copy yet call into any Jaycar store or dealer and pick one up for $1, or send $2 to Jaycar, PO Box 185 Concord. 2137, and we'll post you one.

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Ideal for mounting speakers, strobe lights, security lights, CCTV cameras etc.
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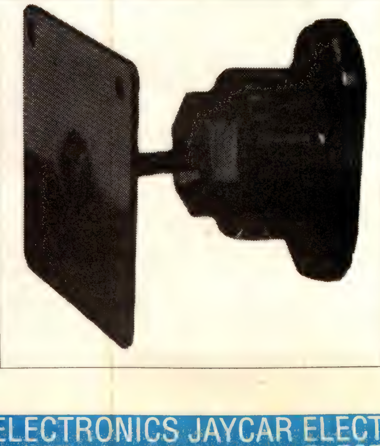

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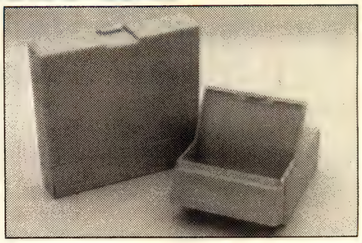
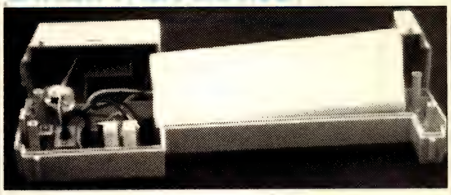


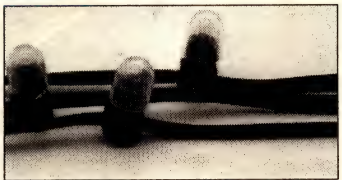
These handy cases hold 10 disks. They are made from high impact plastic, and when fully opened the disks are easily accessible. Available for both 3.5" and 5.25" disks. Colour is light grey.
Holds 10 x 3.5" disks
Cat: XC-4680 **NEW for '94** **$2.95 each**
Holds 10 x 5.25" disks
Cat: XC-4682 **$2.95 each**

SURPLUS BARGAIN BATTERY PACK/CHARGER



This is a Zenith brand battery pack/charger designed to be used with a portable computer. It is housed in an odd shaped grey ABS case. It consists of a Nicad battery pack which is rated at 12V 2500mA. They look like 2 rows of "D" cells and are quality SAFT brand, size 185L x 65W x 35Dmm. There is also a 100mA charger circuit for them built in.Input 12VDC, output 12VDC.
We imagine the battery pack would cost over $100 alone.
Grab one while we have them. Limited quantity.
Cat. MP-3040 **$30.00**

STARLIGHTS - LOW VOLT OUTDOOR LIGHTING SYSTEM



Make your own garden stand out from the rest. Starlights are completely pre- wired and come on a 300 metre reel. So, you simply purchase however many metres you require. There is one bulb every 300mm - so you get 3 bulbs per metre. The cable is green in colour. They are completely waterproof and have clear push on covers which protect the bulbs. Coloured caps are available which are supplied in packs of 25 mixed colours - red, blue, green and yellow.
Ideal to hang through trees, through the garden, around the verandah, under the pergola, indoors etc etc. No electrician is required!!! Bulb life guaranteed for 5,000 hours. Bulb spacing is easy to adjust. Suitable for both indoors & outdoors. Starlights operate on a low 12 volts. Each bulb draws 56mA, so a 1A transformer will allow you to use 17 globes or 5 metres of cable (3 per metre).
Our 1 amp transformer Cat MM-2002 $11.95 will need to be mounted in an enclosure, or out of the way as they are not already enclosed. A 2 amp transformer will allow you to use 34 globes or 11 metres of cable. 2 amp tranformer Cat MM2004 $18.95. If you really want to illuminate your garden you can use a 10 amp transformer Cat MM2009 $46.95 which will allow you to use 178 globes and 59 metres of cable.

3 bulbs / metre - prewired - **Cat. SL-2810** **$3.95/metre** **NEW for '94**

ie: 10 metres (30 bulbs) would cost $39.50 - Note: Sorry no 10% of for 10metres

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Photo size 156 x 112mm Pkt 24
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C	2.25A/Hr	**Cat. SB-2464**	**$9.50**
D	1.2A/Hr	**Cat. SB-2460**	**$5.95**
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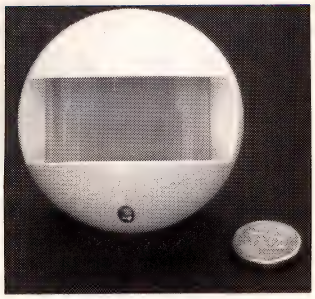

This amazing new PIR has it all! It's not much larger than an egg, measuring 65(H) x 65(W) x 42(D)mm. It has 180° wide field detection, which includes protection either side of the PIR if mounted on a flat wall. It can also be mounted in a corner or on a roof. It has pulse count, which is switchable between one and two triggers. There are 4 different lenses supplied, these are wide angle, curtain A, pet and hall.

Other features: •ultra high level RFI/EMI protection •temperature compensation •calibrated angle scale •dual element low noise pyroelectric detector •silent relay •tamper protection •ultra reliable •miniature size

Specifications:

Power supply:	9-16VDC
Pulse count:	1 or 2 selectable
Current drain:	25mA
Alarm output:	0.5A @ 24VDC
Temperature:	-10°C to 50°C

WARRANTY 1 YEAR

Cat: LA-5022 **$69.95**

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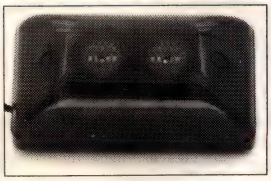

This unit incorporates two piezo screamers giving an unbearable output of 120dB. The strobe section has two Philips brand globes which strobe. It's rain proof, UV stabilised and has a high impact plastic housing. Its also reverse polarity protected. Save a fortune on buying a horn speaker, metal housing and separate strobe.

Specifications:
•Operating voltage:10-14VDC •Current draw: 500mA •Siren output: 120dB •Strobe luminous flux: 251m •Size: 122(L) x 72(W) x 35(D)mm •Cable: 250mm, black stripe neg •Colour: Blue

Cat. LA-5308 **$29.95**

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2N5192 - PKT50PCS
SPECS
80V, NPN, 4A. TO126 Pack

Cat. ZT-2100 Only $10.00

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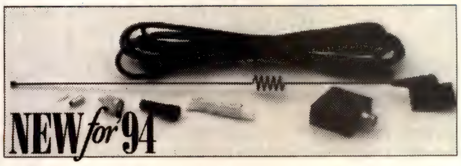

Suitable for all car cellular telephones. This is the antenna you see on all vehicles filled with a telephone. Includes whip with base to go on outside of window and a base to go on inside, 4.4m lead with plug, and a tube of glue compound.

Specifications: •Freq: 800-926MHz •VSWR: Less than 1.6:1 •Gain: 3dB •Impedance: 50Ω nominal •Power: 5 watts cont •Radiation Pattern: Omni-directional

Cat. DC-4040 **$49.95**

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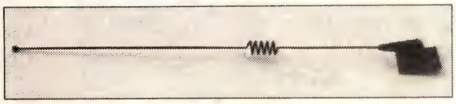
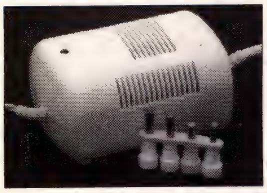
NEW *for* '94



If your car cellular antenna whip has been broken, lost or stolen you will need a replacement. Includes the whip and the small base which sticks onto the window.

Cat. DC-4050 **$19.95**

6, 7.5, 9, 12VDC 1.2 AMP REGULATED POWER SUPPLY

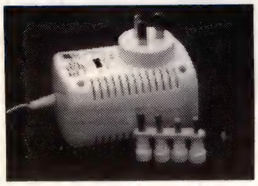


This heavy duty desktop power supply is designed for use with larger products with voltage sensitive requirements. Features overload protection.

Supplied with 4 DC plugs which should suit most needs - 1.7mm (OD 4mm), 1.7mm (OD 4.75mm), 2.1mm and 2.5mm.

Cat. MP-3024 NEW *for* '94 **$55.00**

6, 7.5, 9, 12 VOLT 1.2 AMP DC PLUG PACK



Brand new model for 1994. Lower price and higher current. Plug pack style with LED. Supplied with 4 DC plugs - 1.7mm (outer dia 4mm), 1.7mm (outer dia 4.75mm), 2.1mm and 2.5mm.

Cat. MP-3016 NEW *for* '94 **$42.50**

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The best car converter we have ever seen. If you require more than 800mA to power a stereo etc, this unit will supply 1.5 amps.

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Note - 12V output is not regulated.

Cat: MP-3019 NEW *for* '94 **$26.95**

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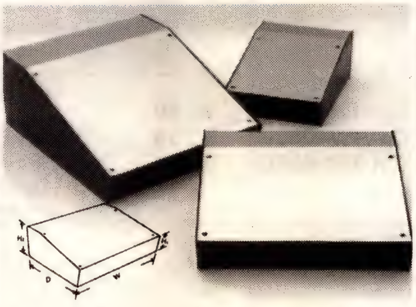

New for 94. Three console boxes made with high quality impact ABS black material. All have sloping fronts and 1mm thick aluminium panel with transparent film to protect it. They also include brass insert screw threads to accept front panel holding screws, rubber feet and self tappers to hold PC boards onto spacers on the base. Three sizes available - all sizes in mm.

Cat	W	D	H1	H2	Max PC Size	Price
HB6090	105	143	31	55	80x128	**$12.95**
HB6092	170	143	31	55	140x128	**$15.95**
HB6094	170	213	31	82	140x198	**$22.95**

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Cat. TS-1000 **Was $179 April $159**
Save $20

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Cat. XC-5040 **$29.95** **WAS $39.95**

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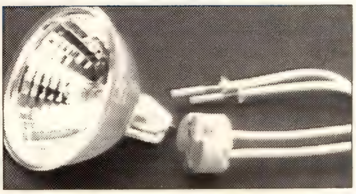
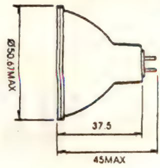


Low voltage 12 volt halogen lighting has become very popular recently. Jaycar now stocks the two most popular lamps with reflectors, and a base to suit, so you can experiment yourself. DIRECT IMPORT: Low cost - normally these are expensive.

NEW *for* '94

20 watt 12v lamp/ reflector
Cat: SL-2730 **$7.95**

50 watt 12v lamp / reflector
Cat: SL-2732 **$7.95**



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Rating 25v 100watt.
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No crossover is required.

Cat. CT-1928 **$99.00**

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KITS KITS KITS KITS KITS

BLUEPRINT KIT

Kit as described including all the additional "Blueprint" features, including the preprogrammed microprocessor and without any remote control.

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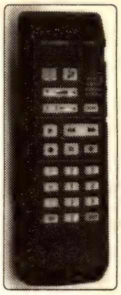
PRE-PROGRAMMED REMOTE CONTROL

Cat: KC-5141 $89.95



Remote control also available separately and can be configured to suit your existing TV, VCR, CD Player, Hi Fi system etc.

Cat: AR-1705 $89.95

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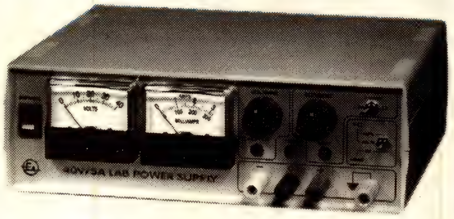


Ref: Electronics Australia Dec/Jan 94

It features full electrical and thermal overload protection, adjustable current limiting, dual panel meters, and can be used as either a single or dual-tracking supply. Specifications: •0 to 40V (0 to +/- 20V) •current up to 3.5 amp.

Kit is supplied complete with case, PCB, screened and punched panels plus all specified electronic components.

Cat. KA-1755 $169.00

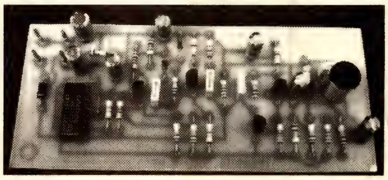
VOICE OPERATED AUDIO SWITCH

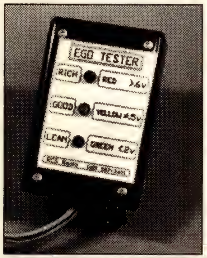
Ref: SC March 1994

This kit differs slightly from a VOX (Voice Operated Relay) which uses your voice input to close a relay. This one switches the audio output on and off.

Kit includes PC board, mic insert and all specified components.

Cat. KC-5149 $14.95





EGO (EXHAUST GAS OXYGEN) TESTER

Ref: EA February 1994

An EGO sensor monitors your engines exhaust and tells the EFI computer if your engine is running lean, balanced or rich - basically telling the computer if your engine is running in tune. This simple circuit is connected to the EGO sensor, engine block and bettery positive and will save you $$$ on tuning by indicating the air/fuel mixture. PCB, case, clips and components supplied.

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Refer: Electronics Australia September 1993. This unit is controlled by your IBM compatible PC printer port. As well as programming EPROMS, it also has a readback feature. It can handle 2716 to 27256, 2816 and 2864. The kit includes case, PCB's, front panel label, high quality ZIF sockets (beware of other kits that only supply one) and all specified components. PC cable is included.

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KIT AMPLIFIER MODULES

See catalogue for full details

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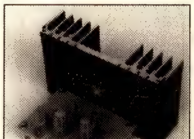

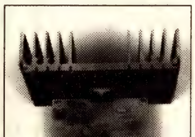

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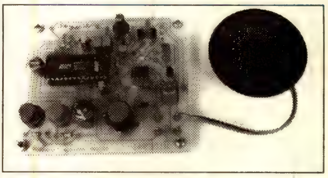

Ref: Silicon Chip Feb 1994

This new version features a larger power amplifier, "pause" button, 90 seconds (1.5 minutes) of continuous record time, zero power memory storage and runs off 6VDC. Kit includes PCB, isostat switches, storage IC plus all specified components.

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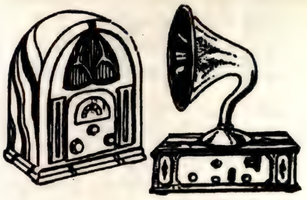
Vintage Radio



by **PETER LANKSHEAR**

Early mechanical TV systems

Public television came late to this part of the world. Australian transmissions did not commence until 1957, and New Zealand had to wait a further five years. Therefore, unlike the Americans and the British with their heritage of old and half-forgotten technologies, like pre-NTSC colour sets or old monochrome 405-line sets, we have little more than 625-line monochrome and PAL models.

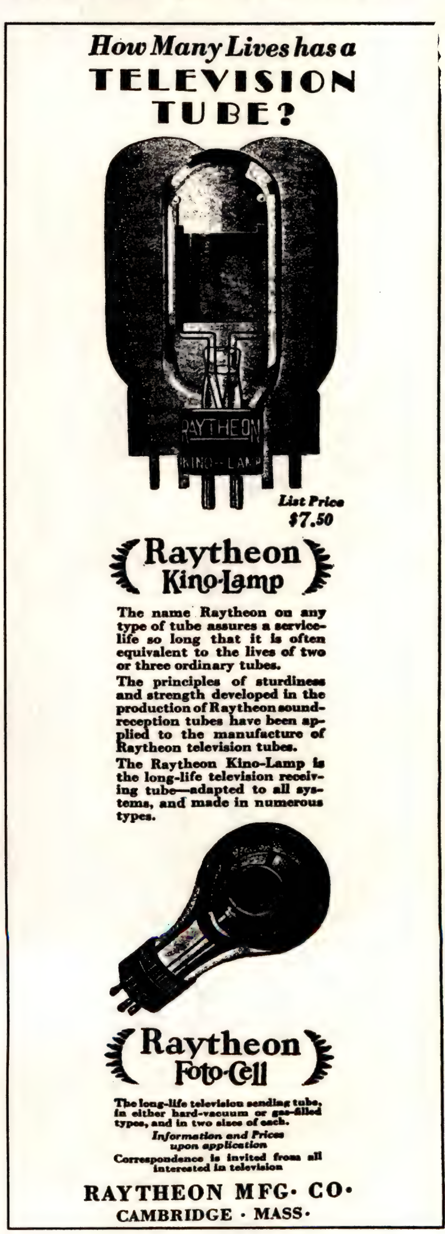
Although we do not have a legacy of pioneer monochrome receivers, it is quite possible that in time there will be collectors delighted to get their hands on — for example — a classic Philips K9 colour receiver. For the present though, we will look at some of the early systems developed long before there was Australasian television.

In Britain and America, old monochrome TV receivers, many now well over 50 years old, do have an important place in collections. Most have small circular picture tubes, some so long that they had to be mounted vertically and viewed in a mirror. But there are even older sets, with mechanical scanning systems — including the 1928 Baird 30-line 'Televisors' with perforated scanning discs, and there are also a few sets with some very sophisticated mirror technology — which, but for the interruption by World War II, might today be far better known.

The fundamental principles of television were worked out in the 19th century, but the technology to make a working system was not available. In 1843, Alexander Bain published his ideas on a facsimile system, laying down the principles of horizontal and vertical scanning and synchronisation between transmitter and receiver. The photo sensitivity of selenium was discovered in 1873.

In Germany in 1884, only eight years after the invention of the telephone, Paul Nipkow suggested that the serial transmission of video data could be achieved by scanning the picture with a spirally perforated disc with one hole for each line. In 1911 the English scientist Campbell Swinton, with remarkable insight, stated that successful television would never be accomplished by mechanical methods. He also described an intricate electronic system, but no working example was then possible. It was only during the 1920's, with the availability of high speed sensitive photo-electric materials, that various workers were able to demonstrate the transmission of images.

Scotsman John Logie Baird, having first failed in a venture to manufacture a



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Raytheon Foto-Cell

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Correspondence is invited from all interested in television

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Fig.2: Essential parts for disc TV were a photocell for transmitting and a neon-filled 'kino lamp' for the receiver.

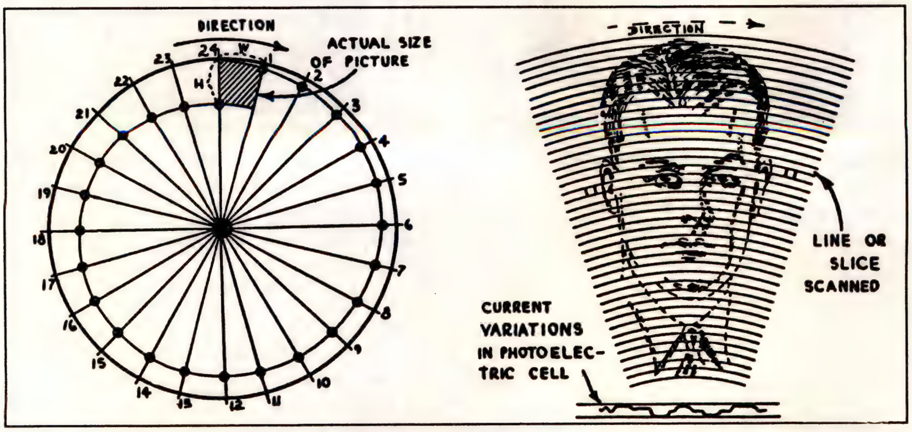
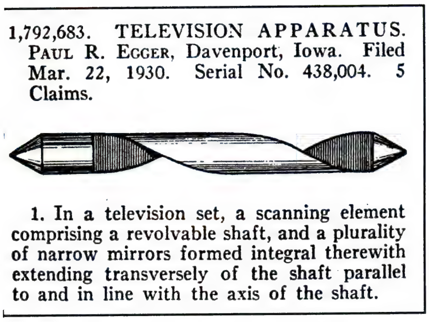


Fig.1: Best known of the early TV systems was the Nipkow disc. This diagram illustrates the size limitations and the wedge-shaped picture with its curved scanning lines. With only 24 or so scanning lines, resolution was quite poor.



1,792,683. TELEVISION APPARATUS. PAUL R. EGGER, Davenport, Iowa. Filed Mar. 22, 1930. Serial No. 438,004. 5 Claims.

1. In a television set, a scanning element comprising a revolvable shaft, and a plurality of narrow mirrors formed integral therewith extending transversely of the shaft parallel to and in line with the axis of the shaft.

Fig.3: The mirror screw represented a major advance on the Nipkow disc This diagram is taken from the original 1930 patent.

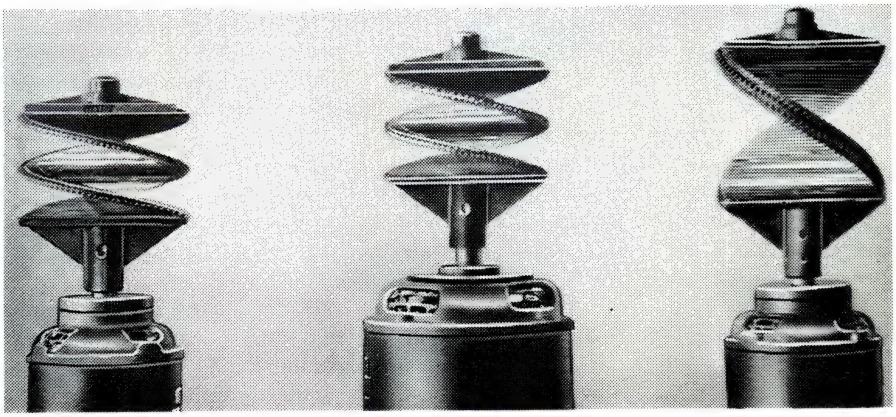


Fig.4: A selection of production model mirror screws (probably 180-line), mounted directly on their motor shafts. It is likely that the multi-turn models were to simplify setting critical mirror angles.

patented undersock and then in an equally unsuccessful jam-making enterprise, was determined to make his forune from television. In October 1925, after two years of experimenting, he demonstrated a crude working system using Nipkow's disc; his dogged but ultimately unsuccessful efforts to develop a commercial TV system have given him a place in history.

Meanwhile, although details of Campell Swinton's work were freely available in publications like Harmsworth's popular 1923 *Radio Encyclopedia*, other workers too, in Britain, Germany and America were persisting with disc scanning experiments.

In America, two farsighted pioneer inventors, Philo Farnsworth and the Russian immigrant Vladimir Zworykin, realised that although mechanical television scanning might give early results, it would ultimately be incapable of sufficient development. As a result they were working independently on electronic methods of scanning.

By 1926 Farnsworth had solved most of the problems of a workable all-electronic system. In April 1930 he was awarded patents for electronic transmitting and receiving technology fundamental to electronic television. Zworykin invented the Iconoscope, and it is the work of these two that provided much of the foundation for today's television systems.

Poor disc images

The images produced by the disc system were impractically small, often not much more than postage stamp size, with a resolution of between 24 and 60 lines. One limitation to the number of lines was the use of broadcast band transmitters with restricted bandwidth.

Initially, the only available source of light that could respond quickly enough to video signals was a neon tube producing a dim pinkish light — substituted for the loudspeaker in a standard receiver. Only head-and-shoulders shots of people had any chance of being recognisable, scenery was out and furthermore the scanning lines were curved with a wedge shaped picture. The electronics were simple, but about the only other merit of the disc system is that it clearly demonstrates the fundamentals of scanning and synchronisation.

Receivers were effectively standard broadcast types, but with a 'Kino' lamp in place of the loudspeaker. In fact, the early Baird 'Televisors' were intended to be driven from the family radio. As line rates increased, the frequency response of receiver audio amplifiers became more important, and resistance coupling became essential.

Synchronisation of mechanical systems was not very sophisticated. If the transmitter and receiver were supplied from the same mains grid, synchronous motors could be kept in step. If however this was not the case, a line synchronising signal could be derived from the video waveform. Fig.6 shows an American system using a 'phonic wheel'. There was no frame synchronisation.

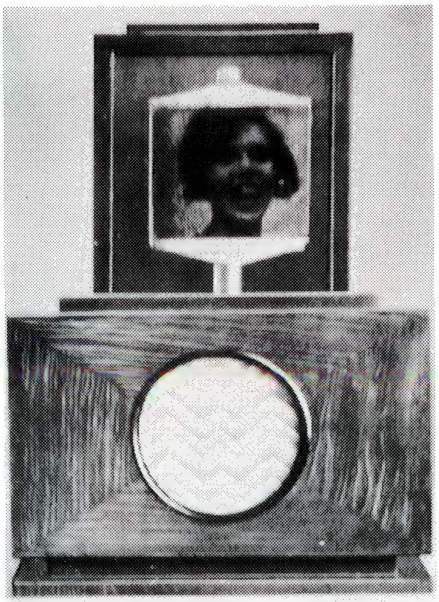


Fig.5: A mirror screw receiver in operation. The light source was probably modulated by a Kerr cell.

The physical constraints of the disc system presented the really insurmountable problems. In line with today's TV, a scanning speed of 25 frames per second or 1500 per minute was commonly used, requiring a rotational speed of 1500rpm — safe for small discs only.

To provide a sharp image, the holes needed to be small, but these attenuated the already low intensity light. Increasing the size of the scanning holes reduced the picture detail. With the dim light produced from neon lamps, only a very limited reduction in disc size was made possible by using magnifying viewing lenses.

Supersonic speeds

An example will demonstrate the utter impracticality of using a disc to provide a reasonable image size. An acceptable picture would be 30cm square, and would use 240 lines at a frame rate of 25 per second. The scanning disc would therefore require 240 holes, spaced at 30cm intervals in a one turn spiral. Simple arithmetic shows that the disc circumference would need to be 240 times 30 centimetres, or 72 metres — giving a diameter of about 24 metres!

With a speed of 25 revolutions per second, the rim of the disc would also have a velocity of nearly 6500 kilometres per hour, over five times the speed of sound...

There is one story of Baird nearly killing himself with an experimental disc only one tenth this size, fitted with 30 large lenses. A disc of even this size with lumps of glass around the rim rotating at 1500rpm is not the sort of device to delight a safety inspector — especially when, as happened in this instance, the lenses became dislodged at 650 kph!

Clearly, the spinning disc was completely impractical for a viable commercial system and better scanning systems were essential for further progress.

New light sources

Major problems to be solved were the need for more effective light generation, better picture resolution and size. Although by 1931, teams from RCA in America and Marconi-EMI in Britain were at work on all-electronic TV systems, many experimenters including Baird were still spending much time and effort in persisting with the disc system. Within a year, however, the physical problems of the scanning disc were finally acknowledged, and development switched to the use of mirrors.

To obtain a faster response and brighter illumination, a scientific curiosity, the Kerr cell, which had been a solution waiting around for a problem, was dusted off and improved.

Photographers will be familiar with the ability of two polarising filters to block the passage of light if the plane of one is rotated 90°. A Kerr cell consists of two correctly oriented polarising prisms separated by a suitable liquid. If a field of several hundred volts is applied to the liquid, polarisation is set up in the liquid itself. This polarisation is proportional to the applied voltage, permitting modulation of the amount of light transmitted through the assembly.

Baird experimented with various liquids in the Kerr cell, finally settling on nitrobenzine. A major improvement was the incorporation of twin prisms, splitting the light into two rays which, after passing through the liquid were recombined by another pair of prisms. However, the light transmission of even this double-image Kerr cell was still very inefficient, some workers even resorting to arc lamps in attempts to provide sufficient image intensity.

The mirror drum

The first and simplest mirror scanning system was a series of mirrors mounted around a drum. Baird Television, who had persuaded a reluctant BBC to permit a pair of their broadcast band transmitters to be used for experimental transmissions, was in 1932 able to sell an improved 'Televisor' with a 9" by 4" picture, using this system. There were 30 mirrors, each carefully aligned so that in one revolution of the drum, their reflections successively scanned the frame (one line to a mirror). Much more compact than the equivalent two-metre diameter disc, and illustrated in Fig.7, this mirror system remained the Baird standard receiver until the end of the lo definition service in early 1937.

Although a considerable improvement over the disc, the mirror drum wa not suitable for more than 60 lines. Setting up the mirror angles was very critical and centrifugal force threw them ou of alignment. However, as we shall see development of the mirror drum wa not finished.

Meanwhile, *vibratory* scanning wa being tried. A suspended mirror wa rocked horizontally and vertically t scan the screen. To improve efficiency the mirror mount was made resonant a the two sweep frequencies, but unfortunately this produced a sinewave rathe than a sawtooth motion, making the trac incompatible with the other systems.

Mirror screws

In 1930, Paul R. Egger, of Davenport Iowa USA filed a patent for a 'mirro screw' array, with a series of angle mirrors, equal in number to the numbe of lines. Much of the development o the mirror screw was done in Germany For a 180-line system, there would b 180 long thin metal mirrors, each displaced 2° (360°/180) from the previou one, making the array like a spiral stairway. The picture line thickness was th same as the mirror thickness, and th mirror lengths became the pictur width. When the screw was rotated, persistence of vision made the mirrors ap-

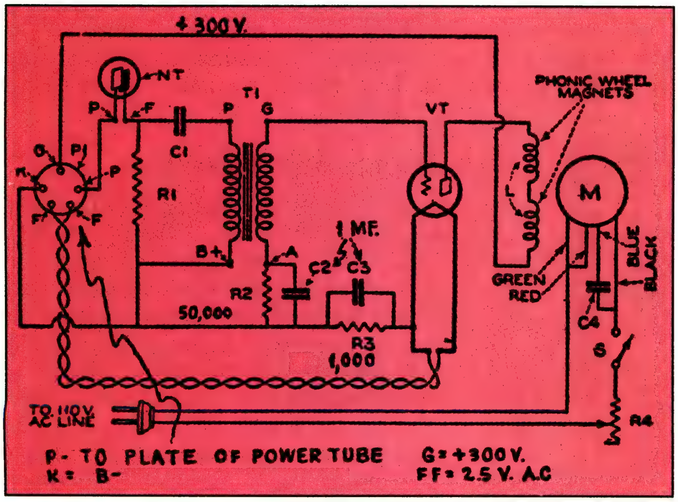
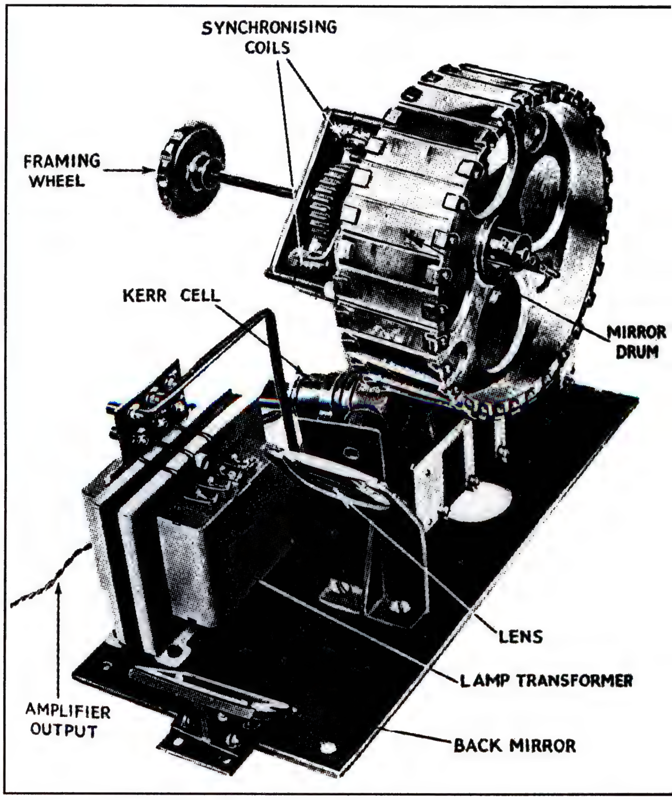


Fig.6 (above): Flywheel synchronisation, 1930's style. This unit was plugged into the output stage of a standard broadcast receiver. The scanning mechanism was driven by a synchronous motor in approximate synchrony. Attached to the drive shaft was a serrated 'phonic wheel' with a tooth for each line, running past the electromagnets in the valve anode circuit. The valve was overdriven so it clipped off the video and passed only the sync pulses.

Fig.7 (right): The 30-line mirror drum from a Baird receiver, as pictured in 'Television, a Guide for the Amateur' (1936).



ear to run together, the image appearing to be as tall as the stack, and as wide s the mirror length.

Illuminated by a Kerr cell, the mirror crew was a major advance in light efficiency and compactness. By the standards of the time, the resolution was igh, and it had a wide viewing angle. ome German 180-line mirror screws vere 9" by 12" (about 23cm by 30cm), vhich would produce an image equivaent to that from a Nipkow disc about 16 netres in diameter.

Mihaly-Traub system

The Mihaly-Traub scanning system overcame the mirror drum problems in a very ingenious way. In the first development, the mirror drum was made stationary, with the mirrors now on the inside and aimed at a double-sided mirror rotating at half line speed at the centre of the circle. Not only were the mirrors in solid adjustment, but each was used twice each revolution, once for the upper half of the picture and once for the lower half.

Later it was realised that with a suitable alignment of the mirrors, and by using a multifaceted rotating prism, a full ring of mirrors was not required. The transmitting unit in Fig.8 used a 10-sided prism and six adjustable stationary mirrors, for 240- or 360-line systems.

Scophony

Scophony, a name derived from the Greek for sight-sound, was the name of the advanced system first conceived in Britain by G.W. Walton. Although based on mirror scanning, Scophony came close to holding its own with all-electronic television. In an innovative split-focus optical system used in the scanning process, the picture was divided into horizontal strips, each one representing one line. Focusing of the light beams was accomplished by crossed cylindrical lenses which concentrated the light in two planes. This allowed the use of smaller lenses and mirrors, thereby reducing the cost and size of the equipment. Scanning was by a 20-sided stainless steel polygon 60mm in diameter.

Although the Kerr cell had been a considerable improvement over the neon lamp, a still brighter light source was required. In 1934, J.H. Jeffree of the Scophony Company developed a modulator with a light transmitting ability two hundred times greater than the Kerr cell. The Jeffree cell operates on the principle that when a supersonic mechanical oscillation passes through a transparent liquid, through which is also passing a beam of light, a series of accelerations and retardations will occur in the light beam. This property can be used to modulate the light beam, with minimal loss in transmission.

The first Scophony receivers had mirror screws, but eventually mirror drums and rotating prisms were used. In 1938, Scophony demonstrated three mirror drum receivers for the new high definition 405-line system. A domestic model with a 22" by 24" picture was never sold, but theatre models with 5 x 6 foot and even 9 x 12 foot pictures were operated successfully. The scanner operated smoothly at 30,750rpm and could be used on the American 441-line system at 39,600rpm!

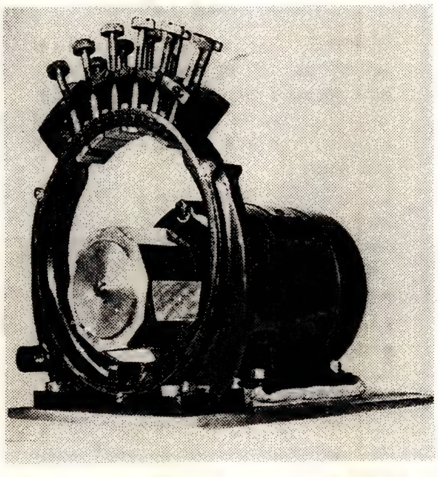


Fig.8: A Mihaly-Traub 240/360-line scanner, with six mirrors and a 10-sided rotating prism, was a considerable advance on the simple 30-line scanner of Fig.7.

With its brighter and larger pictures, rugged reliability and absence of a lethal EHT supply, it is likely that Scophony, had World War II not intervened, would have provided electronic TV with some real competition. As it was, by the time transmissions were resumed after the war, experience gained with radar had given electronic TV such an advantage that mechanical systems were never resurrected.

What's it worth?

As a footnote this month, one question I am frequently asked is "What's that radio worth?" There are no standard values for vintage radio equipment and prices are very dependent on condition, age, fashion and demand.

One recent transaction has caused a few raised eyebrows. If a report, with photograph, in the English *Daily Mail* for September 15, 1993 is to be believed, a 1934 Ekco AD65 sold at a West London auction for £7500 — which, according to my calculations is about A$16,000!

Admittedly, the AD65 with its circular Bakelite cabinet is a very collectable model and this was a rare coloured version. But even so, I do not know any enthusiasts who would be prepared to pay even one tenth of this price.

This report gives credibility to recent American articles asserting that classic radios are a good investment, as they will increase in value in the same way that old cars did a generation ago. This is not a good trend from the point of view of the enthusiast, who is interested in vintage equipment for its own sake, rather than as an investment. ❖

COLLECTOR'S CORNER

Can I request assistance from other readers in obtaining the circuit diagram for an Airzone dual wave receiver, chassis type 604. (Michael Brown, c/- Post Office, Tarraleah, Tasmania 7140.)

Hopefully someone may be able to sell, loan or provide a copy of the circuit or manual for the RCA type SSB-1 Mark IV single sideband transmitter/receiver, made by RCA Victor in Canada. (Dave Matthews VK4YFX, of Townsville, Qld.)

I have an old Philips type R210 radiogram, which I am trying to rebuild. A copy of the circuit and wiring diagram would be most appreciated. (Rod Vinson, Aitken Vale, Qld.)

Hopefully someone can help me with the circuit diagram for a 1956 Electrosound table model radio, which operates on either 240V AC or 6V DC via a vibrator. (Joe Dax, Newcomb, Victoria.)

When space allows, Electronics Australia is happy to publish requests for information on vintage radio equipment. To protect your privacy we don't publish your full address. Please send all replies c/- EA, PO Box 199, Alexandria 2015.

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470 uf 16V	50cents
65 uf 63V	5 for $1
.22 MFD 25V	50cents
1uf 50V	4 for $1
470 uf 10V	50cents
200uf 10V	50cents
47uf 160V	3 for $1
25uf 63V	3 for $1
680 uf 40V	50cents
1000uf 10V	4 for $1
400 MFD 12V	50cents
680 uf 63V	50cents
33uf 10V	4 for $1
2000 MFD 25V	$1

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READER INFO NO. 21

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

April 1944

Improvised radio: Voluntary announcers from the forces are transmitting a regular amateur programme from a small radio station at Milne Bay, improvised by the RAAF out of old equipment.

The general manager of the ABC Mr Charles Moses, described the station on his return from the opening of Station 9PA at Port Moresby.

"The RAAF studio at Milne Bay is a hut, and two old portable gramophones serve as turntables," Mr Moses said. "Seven announcers, all experienced broadcasters drawn from the Army and Air Force, do voluntary duty each night in turn."

Mr Moses said that the ABC had arranged to supplement the library of 190 records with a loan of 500 a month for its station 9PA.

Atlantic clipper: Boeing 314A civil flying-boats, powered with four 1600hp Wright Cyclone FR-26000 air-cooled radial engines, have been operated by BOA on the North Atlantic run since the beginning of the war.

An unorthodox feature of their construction is the use of sponsons for stabilising when on water, instead of wing-tip floats. Accommodation can be for a crew of eight and up to 74 passengers.

April 1969

PAL colour TV: The Postmaster-General Mr Hulme, this month made the announcement which the electronics industry had more or less anticipated — namely that colour television in Austr would be based on the PAL system.

The Government has undertake give 18 months' clear notice before commencement of a colour televi service. It would seem logical that the commencement of such a vice should coincide with the start peak viewing season. In view of th facts, the first possible date on wh colour programs could be seen wo be mid 1971.

Computer controlled network: Japan Broadcasting Corporating Tokyo, has put into operation a comp complex which both plans and ministers the entire production scheduling of two television and th radio networks.

The system, known as TOPICS, forms the following basic functions: tegration of program planning a scheduling; scheduling of product and control of costs; allocation facilities, equipment, and assignment personnel; maintenance of inventories broadcast materials; and control of the-air operations.

The system will also provide mana ment reports when called upon to do and undertake general accounting. ❖

EA CROSSWORD

ACROSS

1. Critical stage in satellite launching. (4-3)
5. Measuring instrument. (2,5)
9. Type of algebra with logical use. (7)
10. Protective coating. (7)
11. Circuits on a track! (4)
12. Timing device. (5)
13. Nature of a film. (4)
16. Region of influence. (5)
17. Allocated radio frequencies. (8)
21. Device that implements a mechanical action. (8)
22. Constriction of a charged stream, the —— effect. (5)
25. Assembly of similar things. (4)
27. Reference list. (5)
28. Rate of flow of heat, etc. (4)
31. Radioisotopes are used for this searching. (7)
32. An accumulator is a —— battery. (7)
33. Part of a tape player. (7)
34. Unit of electrical conductance. (7)

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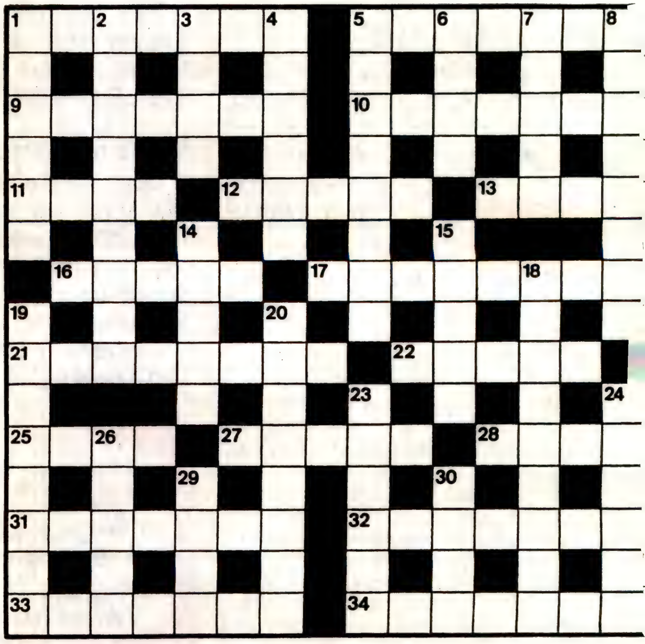
1. Descriptive stickers. (6)
2. Area serviced by a communications satellite. (9)
3. Said of an incomplete circuit. (4)
4. Name of DSE learning kits. (6)
5. Vector quantity. (8)
6. Australian experimenter in shock waves. (4)
7. Type of switch, the —— control. (5)
8. Quality of certain earth elements. (8)
14. British composer of famous marches. (5)
15. Prepare wire for contact. (5)
18. Vibrate. (9)
19. Type of storm associated with sunspot. (8)
20. Discoverer of X-rays. (8)
23. Focusing elements. (6)
24. What an exhaust fan does to air. (6)
26. Brand of microwave oven. (5)
29. Coated with gold. (4)
30. Sequence for access to security system. (4)



SOLUTION FOR MARCH 1994

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Electronics Australia's

Professional Electronics

SUPPLEMENT

NIMBUS DEMONSTRATES ITS MPEG-1 VIDEO CD SYSTEM IN SYDNEY

FIRST PICTURES FROM NASA'S REFURBISHED HUBBLE TELESCOPE: BIG JUMP IN RESOLUTION

LOW COST Z80-BASED PRINT BUFFER DOUBLES AS DEVELOPMENT CARD

HEWLETT-PACKARD MOVES INTO VIDEO IMAGING: NEW 'VIDJET PRO' PRINTER INTERFACE CAPTURES FRAMES, PRINTS THEM VIA A STANDARD PRINTER

NEWS HIGHLIGHTS

NIMBUS DEMONSTRATES ITS VIDEO CD PLAYER IN SYDNEY

A few weeks ago in Sydney, UK firm Nimbus Technology & Engineering (NTE) invited representatives of the local video and broadcasting industry, plus the media, to a demonstration of its proprietary Video CD format and decoder box — which allows the Video CDs to be played via a standard colour TV receiver and many standard audio CD players (those fitted with digital outputs). The demonstration was held in the fledgling Australian Technology Park in Redfern, which is being developed on the site of the former Eveleigh Railway Workshops.

A large number of people attended the demonstrations, which had been organised by NTE in conjunction with its Australian representative D.W. Productions. NTE's Head of Communications and Special Projects, Philip Moss was the presenter, and showed material recorded using both the firm's standard-density format and its double-density format. The material included excerpts from recent Australian feature films, encoded and recorded on a Video CD by arrangement with Village-Roadshow Productions. Played back via Sony professional video monitors and a high quality sound system, the image quality from the Video CDs was most impressive and appeared to be comparable with laserdiscs. The sound quality also compared very favourably with CDs, MiniDiscs and DCC tapes.

The Nimbus standard-density format allows up to 79 minutes of compressed digital video and stereo audio to be recorded on a standard 120mm CD. The double-density format extends this recording time to 135 minutes. Both formats use MPEG-1 encoding, which is optimised for applications such as CD playback. However the format used does not fully conform to the current Philips/Sony 'Red Book' specification, being designed to allow the decoder to be used in conjunction with a standard audio CD player.

The Nimbus decoder is based on a leading-edge decoder chip from C-Cube-Microsystems in California, and is available as both a self-contained box and as a PCB which can be built into existing CD player designs. The estimated retail price for the decoder is around A$300.

Nimbus Technology & Engineering's Head of Communications and Special Projects, Philip Moss, explaining the benefits of his company's video CD system.

So far Nimbus has signed manufacturing agreements with firms in Hong Kong, China and Indonesia, and is expected to announce the mass production of dedicated Video CD players very shortly.

The company says it is also well advanced with the development of a quad-density, double speed format offering 135 minutes of recording time with MPEG-1 video performance better than laserdiscs.

HP, PAC TELESIS TO DEVELOP ONLINE MOVIES

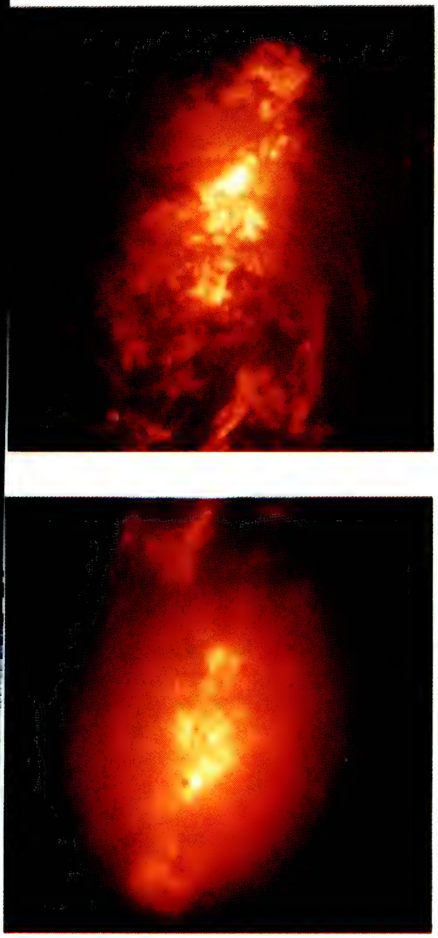
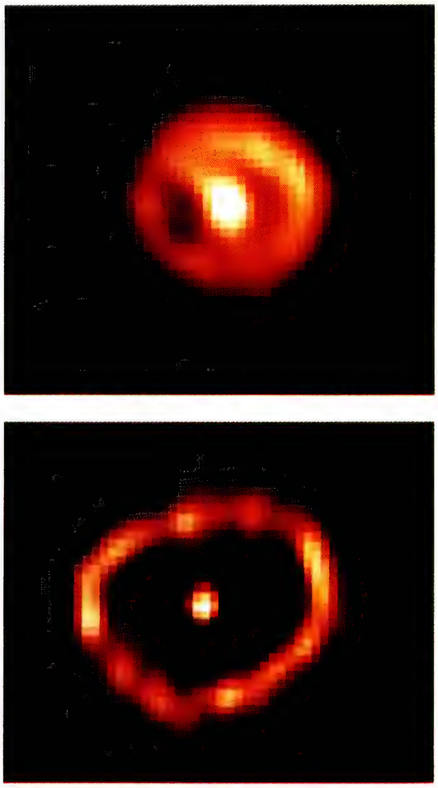
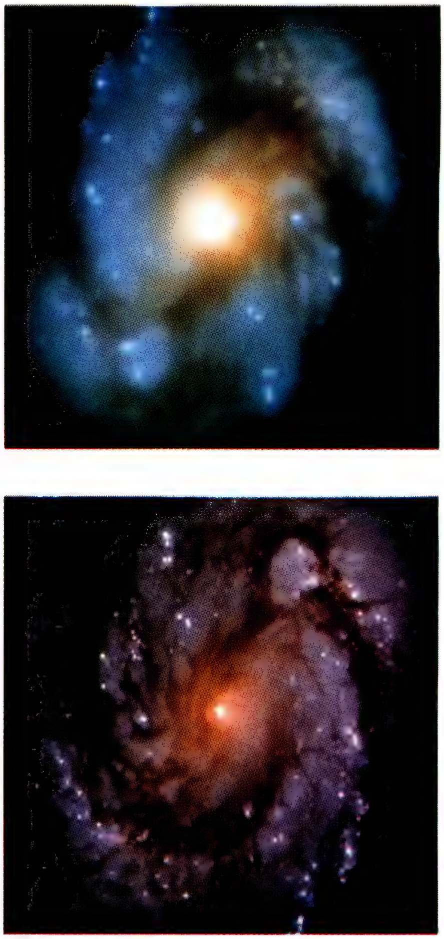
Pacific Telesis Video Services (PTVS) and Hewlett-Packard have signed an agreement to jointly develop an interactive video system to provide consumers in four areas of California with movies and other programs 'on demand', by late this year.

HP is to provide large video servers, to distribute digital video 'streams' to individual consumer homes. The servers will be built around a new technology 'video transfer engine', which is flexible, reliable and upgradeable. The HP video transfer engine is claimed to be more efficient than competing systems, being purpose designed rather than adaptations of standard computers.

HP has announced that it also intends to provide other products for the interactive TV market, including set-top converters, video printers and computers to handle billing and administration.

Movies and other programs 'on demand' are the first video services PTVS plans to offer. Initially, subscribers will be able to choose from a list of hit movies, TV programs and special events. Using a simple remote control device, they will be able to stop, rewind or fast forward a program just as they do today

This story continues on page 108

Left and Centre: Taken with the Faint Object Camera. Right: Taken by Wide Field Planetary Camera 1 and Wide Field Planetary Camera 2.

DRAMATIC PICS FROM REPAIRED HUBBLE

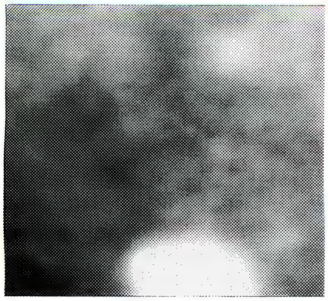
At a recent press conference at NASA's Goddard Space Flight Center in Greenbelt, Maryland, NASA Administrator Dan Goldin declared the December Space Shuttle Mission to repair the Hubble Space Telescope (HST) a complete success, and released the first new images from the telescope. The press conference came at the end of the first five weeks of testing the refurbished HST, including engineering checkout, optical re-alignment and instrument calibration.

"This is phase two of a fabulous, two-part success story", Goldin said. "The world watched in wonder as the astronauts performed an unprecedented and incredibly smooth series of space walks. Now, we see the real fruits of their work, and that of the entire NASA team."

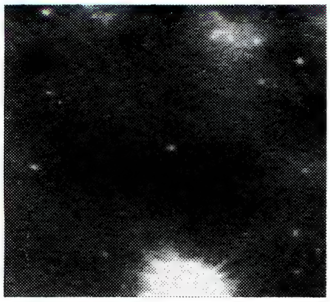
The pictures released were taken by the HST's new Wide Field Planetary Camera Mk2 (WFPC-2) and its Faint Object Camera (FOC), the optics of which has been corrected using the auxiliary CO-STAR module. As may be seen from the samples reproduced here, they show that the resolution of the HST has been markedly improved.

The topmost row of images are those taken with the FOC and WFPC- 1, before the repair; they feature (L to R) the central region of Active Galaxy NGC 1068, Nova Cygni 1992 and the M100 Galactic Nucleus. The next row shows the same objects taken after the repair.

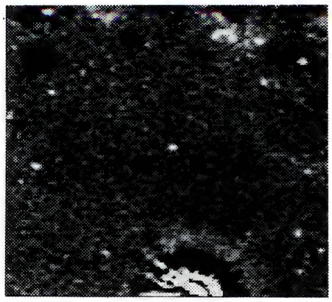
Below are four further monochrome images, all showing the same area in galaxy M100 for comparison. At lower left is the image from the 5m Mt Palomar telescope on earth, on a good night; second from left is the basic image from Hubble's WFPC-1, with its flawed optics; third from left is the same image after 'deconvolving' with a computer; and finally at far right is the image from the new WFPC-2, with arrows indicating details never previously seen.



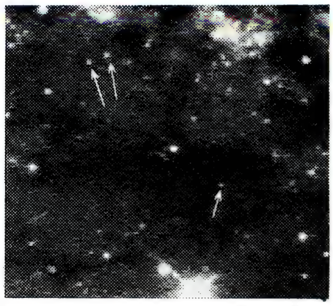
Palomar 5m on a good night



WFPC-1: Wide Field Camera



WFPC-1: deconvolved



WFPC-2: Wide Field Camera

NEWS HIGHLIGHTS

Continued from page 106

with a VCR. The number of movies and other programs available will be expanded as the system develops.

Norwegian firm ABB Nera has developed what is claimed to be the world's smalles Inmarsat-M satellite telephone for voice, fax, and data communication. The antenna and radio electronics are integrated into the detachable lid (shown here on the roof of the vehicle) of a nine kilogram briefcase which can be carried by hand and set up ready for worldwide communication from anywhere, in less than three minutes. It operates from 10 - 34V DC or 90 - 276V AC.

VANUATU BUYS STANILITE CELLULAR

Australian firm Stanilite Pacific has installed its Cellswitch telephone system and mobile telephone equipment for Telecom Vanuatu, to provide the nation's cellular telephone infrastructure. This decision follows a trial of the system during the South Pacific Mini Games, held in Vanuatu during December 1993.

Prior to this, Vanuatu has not had a cellular infrastructure, but businesses — particularly foreign companies wanting to pursue opportunities in Vanuatu — have been lobbying for a comprehensive mobile telecommunications system.

The Games provided the opportunity to trial Stanilite's Cellswitch system, with officials using it for all their communications needs. Telecom Vanuatu was so impressed with Cellswitch's features and performance that it decided to purchase the system, which also included cellular phones and a complete billing and configuration system. A joint team of engineers from Stanilite and Telecom Vanuatu installed and commissioned the entire system within 72 hours.

The system will be maintained by Telecom Vanuatu engineers trained by Stanilite.

The Cellswitch network runs using an AMPS standard protocol, which is far more cost effective than the digital GSM standard. Because it is also currently the predominant standard in countries such as Australia, New Zealand, South America, the United States, Russia and the new Independent States, the Vanuatu cellular system is seen as a vital factor in the promotion of business development as well as tourism.

PHILIPS TO SUPPLY DIGITAL TV TERMINAL

Philips Consumer Electronics Company (USA) has been chosen by Bell Atlantic Corporation as a lead supplier of intelligent digital terminals for the first real digital television and information networks to run over telephone lines. This video dialtone system, a 'roadbed' for the National Information Infrastructure, ('data superhighway') will begin operation next year.

Philips Consumer Electronics and two further principal suppliers will deliver a total of several million intelligent terminals until 1997. This decision is a major breakthrough for Philips, establishing the company's expertise in an area which is considered to become a global market opportunity.

The intelligent digital terminal has been jointly designed by a team consisting of representatives from Philips Consumer Electronics Company of Knoxville, Tennessee; Philips Laboratories, of Briarcliff Manor, New York; and Compression Laboratories Inc., of San Jose, California. It connects the telephone line to the TV set, providing for the individual consumer entry into America's digital superhighway.

The terminal incorporates an easy to operate menu driven graphic user interface. The user will have interactive control of remote source material with VCR-like functions such as Play, Stop, Pause, etc. Two configurations, identical in functionality, will be made available — one for existing copper twisted pair (ADSL), the other converting digital transmissions delivered by fibre-to-the-curb networks. The terminals are based on MPEG-2 (Moving Picture Experts Group) international standard for digital video compression, and the MPEG-specified Musicam audio. They contain micro processing equivalent to a powerful personal computer including 5MB of RAM. The performance will exceed that of existing conventional broadcasting quality, offering picture resolution of 720 x 480 lines and high quality digital sound.

MITSUBISHI DEVELOPS 1.5V THERMOCOUPLE

Researchers at Mitsubishi Materials Corporation in Japan have developed a new type of thermocouple which looks to have applications in providing power to electronic equipment. The thermocouple consists of three P-N junctions in series, all fabricated from $FeSi_2$ ceramic material.

NEWS BRIEFS

- ***Independent Information Technology Training*** is holding two PC troubleshooting courses at Sydney and Melbourne. The first course dates are Sydney (1994) May 25-27, Melbourne May 18- 20. The dates for the second and more advanced course are July 13-15 (Sydney) and July 27-29 (Melbourne). For details phone (02) 252 2844, fax 247 1048.
- The next ***International Broadcasting Convention*** will be held in Amsterdam, September 8-12, 1995. Phone enquiries to 44 (0)71 240 3839 or fax 44 (0) 497 3633.
- Omron Electronics has appointed ***DGE Systems*** as distributor for its range of PCB relays. Phone (049) 61 3311 or 008 818 736.
- ***HPM Industries*** has appointed Robert Pennel as State Manager of its Queensland operations.
- ***Philips Traffic Systems*** has merged with ***Philips Defence Systems*** to become ***Philips Traffic and Engineering Systems.*** Operation will continue to be based at the firm's facility in Moorebank, NSW. ◆

Ieasuring only 30mm long x 6mm
le x 5mm thick, it generates an output
ltage of 1.5V when subjected to a
nperature differential of 600°C, and
n supply a load current of between 20
l 30mA.

Mitsubishi is quoted as saying that the
rmocouples have been tested for 1000
rmal shock cycles (alternately sub-
ted to 800°C and room temperature,
two minutes each), without adverse
ect on their output, and have also been
bjected to baking at 800°C for 500
urs — again with no ill effects. The
ramic material does not oxidise even
1200°C.

The researchers are now inves-
ating using the same technology
fabricate thermocouples with as many
100 layers, to produce output vol-
ges up to 30V.

INGLE-CHIP AX CONTROLLER

Toshiba Corporation in Japan has
oduced the world's first one-chip fac-
nile processor able to reproduce 32-
vel grey scale images. The processor,
C3516F ('Enfax') incorporates all the
ajor circuits required for a facsimile
achine: a 9600bps (bits per second) modem, an 8-bit micro controller unit (MCU), a 32-level grey scale image processor, a mechanical controller, and circuits for encoding and decoding image signals.

The new chip is targetted at low price home and small office use facsimile machines. Mass production is scheduled to reach a level of 80,000 units a month by next September. The 9600bps modem meets the International Telecommunication Union — Telecommunication (ITU-T) standard, and incorporates circuits for a voice recording/reproducing function, sending/receiving dual tone multi-frequency (DTMF) signals and high level data link control framing functions.

The TC35167F incorporates a Toshiba-developed eight bit MCU. Peripheral control circuits includes a DRAM controller, a serial controller (SIO: Serial Input/Output), a controller for the memory (up to 8MB) used to store received images, a motor controller and real time clock.

In addition to its other features, the processor also includes control circuits for a thermal printer head, 40 input/output ports for use in controlling the mechanical parts, a CODEC accelerator for encoding/decoding signals, and a dedicated IC that prevents overheating. It is fabricated in 0.8 micron CMOS and is in a 208-pin QFP package.

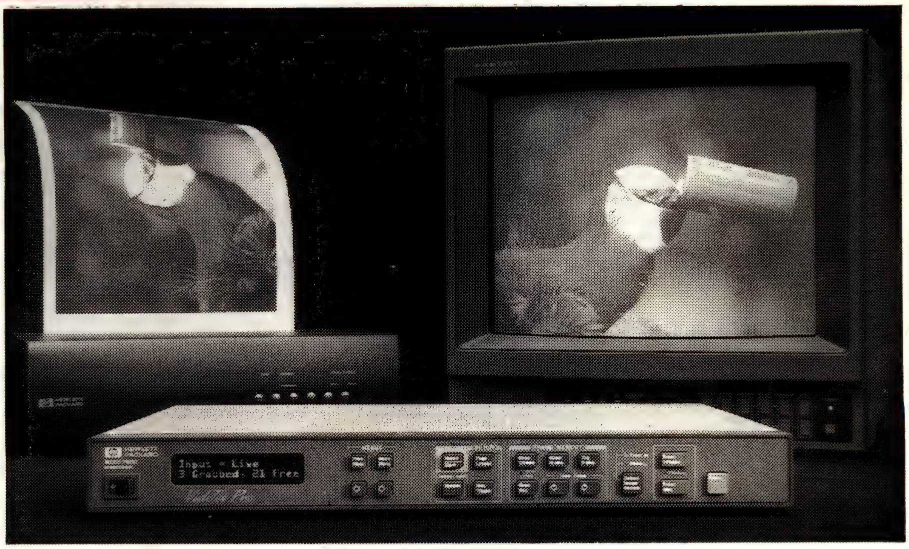
INMARSAT OPENS OFFICE IN CHINA

International communications satellite consortium Inmarsat has opened an office in Beijing, China. China's Beijing Marine Communications and Navigation Company is the country's shareholder in Inmarsat. Speaking at a press conference in Beijing to open the new office, Inmarsat director general Olof Lundberg said that "Both Inmarsat and China are confronting a new era of exciting opportunities. Inmarsat has chosen to evaluate the possibility of setting up regional offices starting with China as its first experimental step, because of the importance Inmarsat places on the developing Chinese market for satellite communications."

"Together with wireless systems, Inmarsat mobile satellite communications can provide remote regions suffering from inadequate communications infrastructure with immediate local and long distance services, contributing to economic development."

Mexico has also joined Inmarsat, becoming the 72nd country to do so.

IDEO PRINTER NTERFACE FROM HP



Hewlett-Packard Australia believes it
ill take the video market by storm with
ie launch of a state of the art com-
unications product.

The product, HP VidJet Pro, is claimed
s a major advance in imaging technol-
gy, enabling video images from any
ource to be printed on plain paper
uickly and inexpensively using most
P printers.

HP has appointed local video
pecialists, Quinto Communications to
arket the VidJet and set the future pace
n video communications. Quinto's
anaging director, Mr Alan McIlwaine,
aid the VidJet and future HP video
roducts would change the way people
ommunicated with videos.

"We anticipate a new era of 'video
aper' which for the first time, makes it
asy for video professionals to capture,
rganise, analyse and archive video in-
ormation on inexpensive plain paper,"
e said. Mr McIlwaine said the VidJet
was a revolutionary product which could
benefit a number of organisations in
industrial, business, science and educa-
ion fields.

"Television stations wishing to obtain
hard copy of images would find the VidJet invaluable," he said. "It would also be useful to post-production companies who could freeze frame television commercial images, print them out and fax them through to advertising agencies. You don't need a pilot's licence to be able to use the VidJet," he said.

"Users simply connect it to any video source, such as a videotape player, television, camcorder, photo CD or laser disc player and to an HP DeskJet or LaserJet printer or HP Design Jet plotter. The VidJet stores images as individual frames, sequences or pre-designated special formats such as the first frame of every scene change, which allows users to print storyboards of an entire production on plain paper. And images can be printed in colour or black and white on plain paper or transparencies."

The HP VidJet Pro was released in February and retails at around $6000, depending on options. For sales information contact Hewlett-Packard's Customer Information Centre on 131347 (Australia wide). ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Voltage to current converters

Unitrode have announced new voltage to current converter ICs, types UC39431 and UC39432, which can be used as optocoupler drivers, shunt regulators, precision references, voltage monitors and in many other applications.

The UC39431 contains an accurate reference source, a wide bandwidth error amplifier, a fixed linear transconductance output stage, and three precision resistors which can be programmed to provide any one of six precisely regulated output voltages.

The UC39432 is similar, except the voltage setting resistor pins are exchanged for uncommitted access to both error amplifier inputs and the voltage reference. It contains the same accurate reference source and error amplifier, but it also includes a variable linear transconductance amplifier, thus allowing more closed-loop control in an optocoupler feedback loop application. The transconductance stage gain is set by an external resistor, and the output voltage for shunt regulator applications is determined by an external divider.

For more information circle 272 on the reader service coupon or contact Priority Electronics, 23-25 Melrose Street, Sandringham 3191; phone (03) 521 0266.

5V to 3.3V/7A controller

The MAX767 from Maxim Integrated Products is a high efficiency synchronous step down power supply controller able to convert a fixed 5V supply to a 3.3V output at up to seven amps, without a heatsink. Suitable for use in desktop or portable computers, the MAX767 has a very small size, due to the high operating frequency.

The 300kHz operating frequency allows the use of small low cost external surface mount components. The inductor, at 5uH for 5A, is much smaller than inductors typically used in this application. The all N-channel construction and synchronous rectification gives an efficiency exceeding 90% over a wide range of loading, eliminating the need for heatsinking. The input range is 4.5V to 5.5V. The quiescent supply (750uA) drops to 125uA in the standby supply.

For further information circle 281 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

Programmable logic devices

Lattice Semiconductor has announced programmable logic devices (PLDs) targeted at the rapidly expanding PCMCIA market. The devices, types pLSI1032 and ispLSI1032 are packaged in thin quad flat packs (TQFP) and combine the ease of use and fast system speed of PLDs with the density and flexibility of FPGAs (field programmable gate array). The ispLSI1032 has the added feature of 5V in-system programmability.

Although the primary focus of the devices is PCMCIA cards, they are ic
ly suited to other markets such as h
held instruments and portable compu
which demand low profile packag
The ICs are supported by Lattice's
and pDS+ development tools. The
provides an easy to use PC Windows
terface and works with industry stand
third party design tools such as Data I
ABEL and Viewlogic.

For further information circle 271
the reader service coupon or con
Zatek Components, 1059 - 1063
toria Road, West Ryde 2114; ph
(02) 874 0122.

DSP specific FIFO memory

First-In-First-Out (FIFO) memories specifically designed for digital signal processors (DSPs) are now available from Texas Instruments.

Designers can now reduce I/O bottlenecks by eliminating the discrete glue logic devices typically used to interface general purpose memories to DSPs. Integrating interface logic onto FIFO memories also increases the reliability of the system and reduces the board space required by the design, making DSP s
tems more compact.

DSPs are often used in real time
computationally intense applications su
as image processing, telecommuni
tions, multimedia, high speed graphi
instrumentation, and medical equipme
In such applications, the new DSP FIF
from TI do not limit the speed of a D
to the speed of the I/O bus.

For example, serial data from discr
analog-to-digital converters can be b
fered by the FIFO memory and s
directly to the processor as parallel d
at the high processing speed of the D
Conversely, data from the DSP dev
can be stored in a DSP FIFO at hi

speed, before being transmitted at the slower speed of the I/O bus.

The first device in TI's new family of DSP FIFOs is the SN74ACT3632. The device comes in three speed versions with cycle times of 15, 20 or 30 nanoseconds. It features write/read speeds up to 67MHz and access times as low as 11 nanoseconds. Other features include integrated microprocessor control logic for easier interface to TI's TMS320C3x and 'C4x DSPs, as well as DSPs from other vendors. The SN74ACT3632 is packaged in a 132-pin PQFP (plastic quad flat pack) or, for compact designs, a 0.4mm pitch 120-pin thin quad flat pack (TQFP).

For further information circle 279 on the reader service coupon or contact Texas Instruments, 6 Talavera Road, North Ryde 2113; phone (02) 878 9000.

Three port universal bus transceivers

The industry's first three port universal bus transceivers (UB), now available from Texas Instruments, help computer system designers effectively implement complex system configurations such as multiprocessor architectures, memory interleaving or bus multiplexing/demultiplexing.

Unlike most transceivers which provide a two port bus interface, TI's two new universal bus transceivers interface three bi-directional buses to each other. The devices can function in flow-through, latched, clocked or clock-enabled modes, further reducing board space requirements by combining capabilities typically featured in multiple discrete devices. The devices also make smaller designs possible by featuring a bus hold cell on all data inputs, eliminating the need for pull-up resistors on unused or floating inputs. Designated the SN74ABT32316PN and the SN74ABT32318PN, the devices are configured as 16 and 18-bit UBTs, and have a maximum propagation delay of 6.5 nanoseconds.

At 1mA, the devices dissipate very little power in standby mode, and can provide output drive currents of -32 and +64 milliamps.

For further information circle 277 on the reader service coupon or contact Texas Instruments Australia, 6 Talavera Road, North Ryde 2113; phone (02) 878 9000.

High speed digital signal processor

Toshiba has announced a new high speed digital signal processor for digital audio equipment. Called TC9332F, the new device offers sound equalisation, dynamic range control, sound field control and audio signal level detection. It is expected to enhance digital audio signal processing in such equipment as small size stereo systems, car audio, compact disc players and electronic musical instruments.

Sample shipments of the new product to the Japanese market began on February 1, 1994 and sample shipments overseas started on March 1. Mass production will begin in June at a volume of 20,000 units per month. The new device incorporates a dedicated random access memory for delay control, giving reduced manufacturing costs and cutting the size of the circuit board. By processing different signals in parallel, including calculating, storing calculated data and data delay control, the TC9332F offers a 60 nanosecond instruction cycle time, placing it among the fastest devices in this class. This supports highly complicated processing of digital audio signals requiring up to 340 calculating steps.

For further information circle 273 on the reader service coupon or contact Toshiba Australia, PO Box 350, North Ryde 2113; phone (02) 887 3322.

Low power 12-bit DAC

Maxim Integrated Products' MAX530 is the newest addition to a growing line of 5V, ultra low power data conversion products designed for portable and battery powered applications. The MAX530 is a parallel-input, 12-bit D/A converter which operates on 5V or +/-5V supplies. It requires less power than any other equivalent voltage output device — only 400uA (maximum) from a 5V supply.

An internal bandgap reference provides a 2.048V output which may be scaled up or down, inverted, or left connected for multiplying applications. The DAC performs four-quadrant multiplication without external resistors or op-amps, and the output voltage range in those applications includes both supply rails. Otherwise, the buffer amplifier's internal gain setting resistors define output ranges of 0V to 2.048V, 0V to 4.096V, or +/-2.048V.

The device is guaranteed monotonic with a relative accuracy better than +/-1/2LSB. Its double buffered parallel data inputs are compatible with four, eight and 16-bit microprocessors. An internal reset circuit sets all data inputs to zero during power up and burn in.

For further information circle 280 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511. ❖

Quad SPST switches

Maxim Integrated Products has announced the MAX351, MAX352 and MAX353 quad precision analog switches. The MAX351 is configured as four normally closed switches (NC); the MAX352 as four normally open (NO) switches; and the MAX353 as two NO and two NC switches.

On-resistance for all three devices is less than 35 ohms, guaranteed to match within two ohms between channels and to change no more than three ohms over the full analog signal range. Each device has a leakage less than 250pA at +25°C and less than 6nA at -85°C.

The ICs are fabricated with Maxim's 44V silicon-gate process. The 44V maximum breakdown voltage allows rail-to-rail analog signal handling capability. They operate with a single positive supply (+100V to +30V) or with split supplies (+/- 4.5V to +/-20V) while retaining CMOS logic compatibility.

The switches come in 16-pin DIP and narrow-SO packages, screened for the commercial (0°C to 70°C), extended industrial (-40°C to +85°C), and military (-55°C to +125°C) temperature ranges.

For further information circle 276 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

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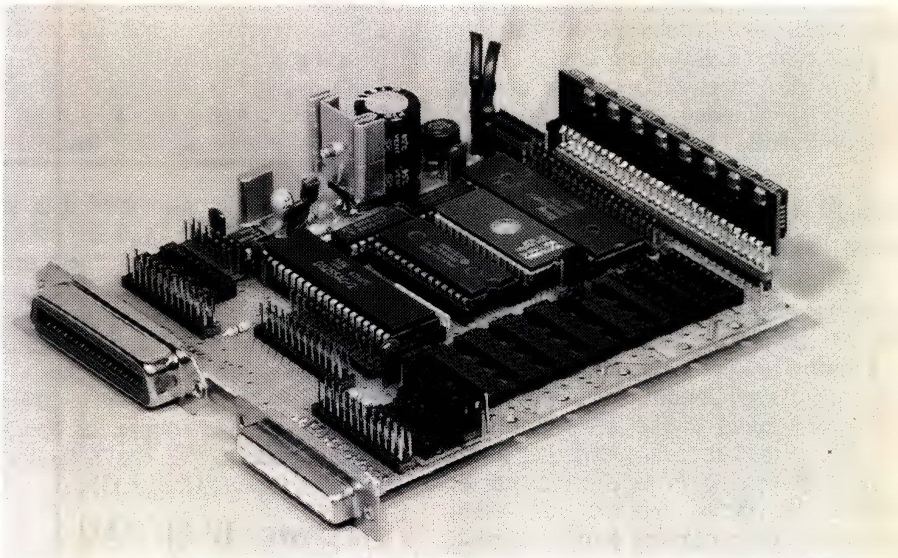
READER INFO NO. 22

Kit for Printer Buffer, Z80 Development Board

Innovative Melbourne-based kit supplier Don McKenzie has not only upgraded his very popul Printer Buffer kit to provide a buffer capacity of up to 4MB, but also designed it to double as a lo cost development system for Z80 based microcomputers. This should make the kit of interest to a even wider group of potential users.



Mr McKenzie tells us that to date he has sold no fewer than 4000 short-form kits for his 'PBUFF' Printer Buffer design, since it was introduced in 1986. That's certainly very impressive, in anyone's terms. Based on a dedicated Z80 micro, it initially had a buffer of either 64KB or 256KB, and was designed to 'free up' personal computers when using Centronics-type parallel printers. Since then, it has been upgraded first to a maximum capacity of 1MB, and more recently to 4MB.

With the latest revision, however, Mr McKenzie has taken the opportunity to make the design even more flexible, so that the board can now also be used as a low cost development system for those designing or building equipment around dedicated Z80 chips. The one new short-form kit therefore also replaces the earlier 'ZLOAD' development system kit.

In addition to an 8/16KB EPROM and 8KB static RAM, the board can accept either eight separate DRAM chips (4164, 41256 or 4C1024), or a SIMM or SIPP memory module (256KB, 1MB or 4MB). The 8255-based I/O logic can also be configured in many ways, to customise the board for a variety of applications. The board includes a bridge rectifier and 5V regulator, and can be powered from a 9V supply of either AC or DC.

Why a development board for Z80 based projects? Simply because the Z80 micro is a powerful and time proven processor which is readily available at low cost — around $6 in single quantities. Although it needs to be teamed with other chips such as a separate ROM, RAM and I/O interface for dedicated applications, this still makes it very competitive with 'newer' micros designed more specifically for dedicated use, in terms of both cost and availability.

As a development system, the board is intended to hook up to an IBM-compatible PC using MS-DOS, via the parallel printer port. Together with the etched board, Mr McKenzie supplies a set of development software including the fast public domain Z8T cross-assembler, Z8T BASIC, and source code, plus full circuits.

The board can be operated at 3.58MHz using a Z80A processor, 6MHz with a Z80B or 10.94MHz with a Z80H.

An optional 16KB EPROM is available containing both the software for using the board as a printer buffer, and that for using it as a Z80 development system. Ful source code is provided, for all th software and firmware.

The new PBUFF/ZLOAD short-for kit for the Printer Buffer/Z80 Development System is priced at only $49, an includes PCB, EPROM and software. Th firmware in EPROM is also availabl separately for $20, while the PCB and dat alone cost $35. In each case handling an postage adds $3.00.

Other kits currently available from Do McKenzie include 'PPEX', an I/O expansion board which connects to the printe port of a standard PC, to provide it with up to 64 bits of programmable parallel I/O ($35 for PCB and software, plus postage); 'PPEXREL', a relay driver board which drives up to eight low-cost relays from the PPEX board; and 'MAXCLOCK', a PC-driven serial interfacing duo-decimal clock display based on the Maxim MAX7219 serial display driver.

Also available are low cost SRAM, DRAM and EPROM memory chips, and also SIPP and SIMM memory modules.

Further information (including a promo/data 3.5" floppy disk, for $2) is available from Don McKenzie, 29 Ellesmere Crescent, Tullamarine 3043; phone (03) 338 6286. (J.R.) ❖

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READER INFO NO. 23

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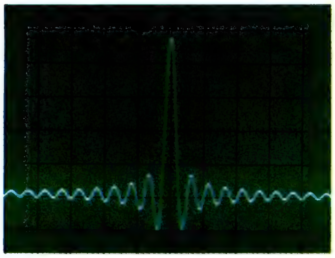
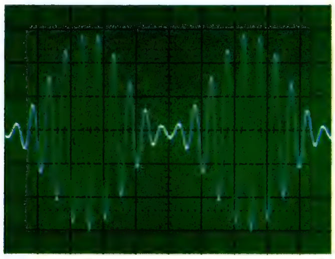
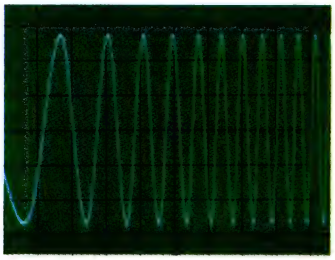


A built-in 12-bit, 40 MSample/sec, 16K deep arbitrary waveform generator easily handles your custom waveform needs.

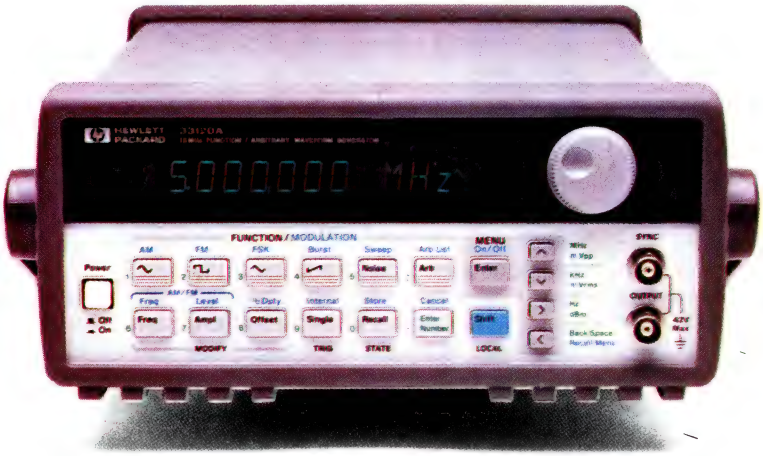


Internal AM, FM, FSK and burst modulation eliminate your need for a second modulation source.



Both linear and log sweeps are built in, making filter and amplifier testing quick and easy.

At a price that falls below them.



The HP 33120A 15 MHz synthesised function/arb generator: Within budget, without compromise.

In the world of function generators, price and performance have always been synonymous. So it's understandable you'd expect to pay more for the measure of confidence you get with a synthesised signal source that delivers stable, accurate signals test after test. Or, for the flexibility to generate complex waveforms with arbitrary waveform capability.

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Product review:

Compact 160W DC-AC inverter from DSE

Featuring high-frequency 'switchmode' circuitry, this little 12V DC to 240V AC inverter from Dic Smith Electronics offers a high short-term power capability, comprehensive protection circuitry an an impressive conversion efficiency of around 90%.

by ROB EVANS

The current crop of DC-AC inverters on the market certainly demonstrates how advances in both semiconductor devices and circuit techniques can dramatically reduce the size and weight of a product, and improve its performance. While we've grown accustomed to the trend for computers to shrink in size while increasing their power capability, it seems as if DC-AC inverter technology has crept up from behind and suddenly made a spectacular change in the last year or so.

It's hardly surprising then, to learn that this transition owes much to advances in the techniques and components used computer power supplies.

In a similar manner to these switchmode supplies, most recent DC-AC inverters use high-frequency switching circuitry — which allows the use of a very small inverter transformer — and efficient MOSFET switching devices which offer an 'on' resistance in the fractions of ohms. And contrary to more traditional inverter designs where the actual power conversion process was performed at the 50Hz main rate using a bulky inverter transformer, the 12V DC input power is now converted to a around 300V DC (at a switching rate of many kilohertz), then alternately switched to the Active and Neutral output pins at a 50Hz rate.

The output waveform from this type of unit generally takes the form of a 'modified' squarewave, which has a few milliseconds of rest period (0V) between each half cycle. The idea here is that the synthesised mains supply from the inverter then offers both a *peak* and *RMS* voltage which is similar to that of the mains, and should therefore satisfy the requirements of most types of 240V AC loads — and in practice, this method appears to be quite effective.

These techniques pretty well sum up the circuitry used in the new DSE inverter, which offers all of the inherent advantages of this latest trend. For a nominal continuous power rating of 160W, it measures just 180 x 110 x 60mm and tips the scales at only 1.1kg.

As you can see from the photo, it's a rather plain looking unit with just a single mains outlet and an associated power on/off switch on the front panel; the heavy-duty 12V DC inlet cable passes through the rear panel. The cable's free end is then terminated in a standard cigarette lighter plug, so that the unit can be quickly connected to a vehicle's 12V system.

With the exception of the front and rear panels, the case itself is formed from an extruded aluminium section which doubles as a heatsink for the internal switching MOSFETs, and has a black anodised finish. All in all it has a functional, no-frills appearance, but as we subsequently found when the unit was put through its paces on the test bench, its performance is all that we've come to expect from this type of high-frequency switchmode inverter...

Testing, testing

Using a high-current 12V DC sourc we first monitored both the inverter input and output power while it wa driving a variety of 240V AC load, which ranged from banks of light glob through to an assortment of domesti appliances (including a hand-held pow drill).

With the unit operating at its rate power (160W), the output voltage wa measured at 232V AC (using an RMS reading voltmeter) and the overall ef ficiency calculated at just over 90% This is an excellent result in terms c efficiency *and* output regulation, sinc the inverter's off-load output voltag was also 232V RMS — there was vi tually no output voltage 'sag' betwee the no-load and rated load conditions...

As it turned out however, we foun that this was partly due to the inverter' tendency to overcompensate (in RMS voltage terms) when delivering lowe power levels.

With 60W and 100W loads for example, the output voltage increased t 243V RMS and 238V RMS respective-

, so it seems that this slight overcomensation neatly balances out the output osses when the unit is delivering its ated power. With 60W and 100W loads e efficiency was also measured at 0%, by the way.

The inverter also performed well hen delivering powers in excess of its ominal 160W rating. With a 230W ad the output voltage was measured at 20V RMS, and despite a slightly lower fficiency figure of 87%, it took several inutes of this sustained load before the nit's case/heatsink became noticeably arm. With this level of reserve power nd its high-temperature shutdown feaure, we'd expect that the inverter hould cope with the most rigorous of perating conditions.

Our collection of 'real world' loads including various appliances, an IBM-ompatible computer, a hifi system and television receiver) had little difficulty n coping with the inverter's 'modified quarewave' output signal, with only ninor interference picked up by an M tuner when tuned to a weak station. n the other end of the spectrum in omestic loads, a 200W-rated power rill would initially cause the inverter to hut down (due to excessive load resented by its largely inductive notor), then successfully come up to peed with sufficient power to cope with nost drilling jobs.

Other than the unit's performance into various loads, we also checked its output frequency (quite stable at 50.2Hz), its idling/standby current (around 100mA or 1.2W), and the input voltage sensing features.

Here, the inverter activates an audible alarm if the DC source voltage drops to less than 10.7V, and shuts down the 240V AC output if the input level falls below 10V — hopefully, this would leave sufficient energy in a vehicle's battery to start the engine.

Finally, we couldn't resist the temptation to have a peek at the inverter's internals, and had the unit apart in short order. The circuitry is neatly housed on a single PCB which occupies the entire width of the unit, and as we've come to expect from this style of inverter, uses a relatively small inverter transformer (thanks to the 100kHz switching frequency used in this unit) and a modest number of low-power components.

We also noted the use of a 25A automotive blade-type fuse in the 12V input line, and the TO-220 packaged switching MOSFET devices used in both the DC-DC inverter section (three) and the AC output steering bridge circuit (four).

The internal inspection also brought to our attention a slightly disturbing aspect of the 240V AC output wiring, involving the 'AC power' on/off switch. With the circuitry used in this particular inverter, an identical train of 300V pulses is applied to both the Active and Neutral terminals, but with the latter shifted in phase by 180° — while the Active output is at 300V the Neutral pin is forced to 0V, and vice-versa.

This in turn means that *between* the Active and Neutral terminals (say, using the Neutral pin as the reference rather than ground) we have a waveform with a peak-to-peak level of 600V and an RMS value of 230V.

So while the mains socket in your home normally has (or should have) the Neutral pin at ground potential and the full mains waveform appearing at the Active pin, the DSE inverter has 50Hz energy at *both* pins, with respect to ground.

And the unsettling aspect of its output wiring is that only the Active pin is disconnected by the unit's front panel SPST power switch; the Neutral pin remains connected to the inverter's circuitry and continues to produce its share of the output energy — that is, a string of 300V pulses which measure about 140V RMS with respect to ground. This occurs while ever the inverter remains connected to the 12V DC supply.

Frankly, we'd rather see a DPDT power switch in this unit so that the 240V AC output is totally isolated. Either that, or the switch could be omitted all together and replaced by a 'power on' indicator neon wired across the 240V output. Or better still, the inverter power could be switched on the low voltage DC side, rather than the output side.

As it stands, when the unit is connected to a 12V DC source there is still substantial energy available at the outlet socket (with respect to ground), despite the fact that the power switch is in OFF position and its internal indicator lamp is extinguished.

Other than this criticism though, we're quite impressed with DSE's little inverter. It's compact and light in weight, offers comprehensive electronic protection circuitry, and delivers an impressive performance with a general efficiency of around 90%.

At a current price of $249, it should nicely suit those who quickly need modest amounts of efficient 240V AC power in a mobile environment. The unit is available from Dick Smith Electronics stores as you would expect, and has a catalog number of M-5010. ❖

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Volume 2

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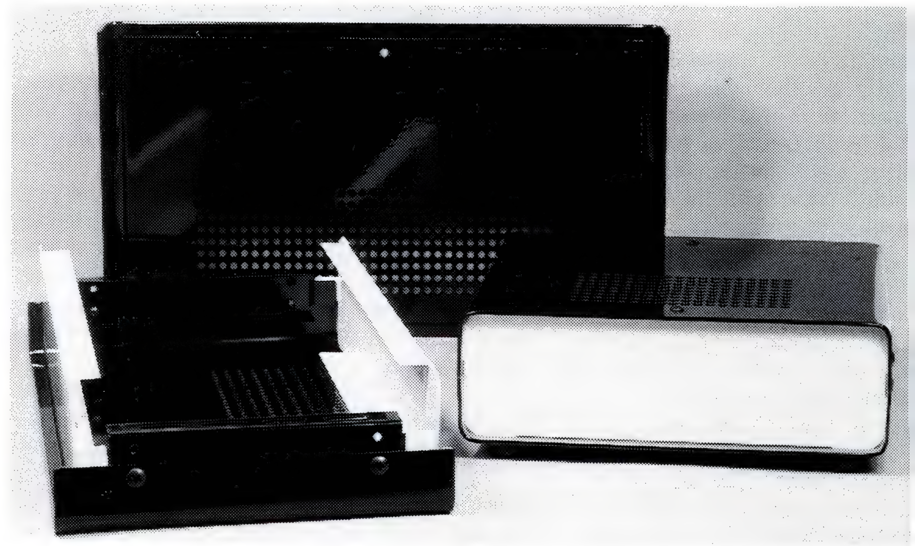
New project, instrument cases

Two new ranges of metal cases have been added to those stocked by Dick Smith Electronics. Or range is a series of pressed steel and aluminium instrument cases which conform to the IEC2 standard, while the other is a pair of sturdy Australian-made finned project cases based o aluminium extrusions.



Although the steel/aluminium instrument cases were displayed in the 1993/94 DSE catalog, unexpected supply problems delayed their arrival and in fact they have only been added to stock relatively recently. However the wait has been worthwhile, because the cases are very nicely made and well finished. They come in 'knocked down' form, and consist of six main elements: front and rear panels, upper and lower U-shaped case halves, and smaller U-shaped strips which fit inside at either end, to both fasten the upper and lower halves together, and also provide internal mounting 'ledges' for PCB's, etc.

The front and rear panels are made in 1mm-thick aluminium for easy drilling, reaming and nibbling, and are finished in gloss white. The remaining metal parts are thinner but in sheet steel for overall rigidity of the assembled case, and are finished in gloss black. Both upper and lower case halves are prepunched with a generous array of ventilation holes, and are also folded over double at the exterior edges for increased rigidity.

Case assembly is via round-head machine screws, mating with holes tapped in the small end pieces and in the returns of the front and rear panels. This is perhaps the only area of potential weakness, as the tapped hole length is inevitably short and the thread can be stripped relatively easily by overtightening of the screws — particularly with those which mate with the aluminium front and rear panels.

Although the case front and rear are attached using only a single pair of screws (centrally at top and bottom), cranked lugs at the ends of the small internal end pieces prevent more than a small amount of inward movement at the ends. The folding of the top and bottom sections also serves to resist outward movement, although if additional rigidity is required, further holes could be drilled and tapped near the ends, for additional screws.

There are eight models in the new range, with the smallest (H-3100) measuring 203.2 x 177.8 x 63.5mm, and priced at $19.95, to the largest (H-3114) which measures 304.8 x 279.4 x 132.0mm and is priced at $59.95. All models come complete with assembly screws and four adhesive rubber feet.

The Australian-made finned aluminium project cases are very sturdy and also designed to dissipate heat readily — making them well suited for applications such as small converters and inverters, burglar alarm and automotive electronics, etc. They are based on two different aluminium extrusions, both of which feature a lower section which extends out at the sides to form mounting flanges.

The smaller of the cases (H-3000 measures 32mm high and 70mm wide with the mounting flanges extending t 106mm overall; it has a length o 140mm, excluding the 3mm-thick en plates, and the extrusion is a singl piece. This case is priced at $19.95.

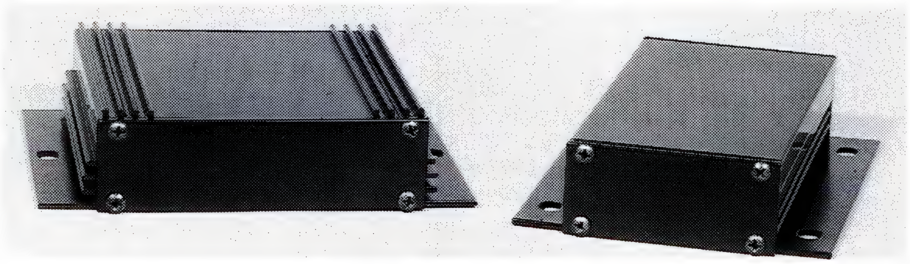
The larger case (H-3005) measure 38.4mm high, 109mm across the top an 145mm across the mounting flanges with a length of again 140mm excluding the 2mm-thick end plates. In this case the extrusion is of two pieces, with the sides integral with the base but the top in the form of a close-fitting panel which slides out for better access to the inside. This case is priced at $24.95.

Both cases can be made effectively waterproof by running a small bead of silicone sealant around the ends of the extrusion(s), before the ends are screwed on.

Cases of other lengths could obviously be provided using these extrusions, and further sizes may be added to the DSE range if there's sufficient demand.

In each of the two cases the extrusions feature both internal slots for horizontal PCB mounting, and internal flats for mounting flat-pack semiconductors. The cases are finished in matt black, and have slotted holes prepunched in the mounting flanges.

All of these new cases are now in stock at all DSE outlets. (J.R.) ◆



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- MTBF > 100,000 hours
- Single output versions available on NFS40 series

Model	Output Voltage & Max. Current	Max. O/P Watt	
		Free Air	Forced Air
NFS25-7608	+5.1V,2.0A; +12V,1.5A; −12V,0.2A	25W	–
NFS25-7628	+5.1V,2.0A; +12V, 0.2A; −12V,0.2A	25W	–
NFS40-7607	+5.1V,5.0A; +12V,2.0A; −5V, 0.5A	40W	50W
NFS40-7608	+5.1V,5.0A; +12V,2.0A; −12V,0.5A	40W	50W
NFS40-7610	+5.1V,5.0A; +15V,2.0A; −15V,0.5A	40W	50W
NFS40-7628	+5.1V,5.0A; +12V,0.5A; −12V,0.5A	40W	50W
NFS42-7608	+5.1V,3.5A; +12V,2.5A; −12V,0.3A	40W	–
NFS42-7610	+5.1V,3.5A; +15V,2.0A; −15V,0.3A	40W	–
NFS42-7627	+5.1V,3.5A; +24V,1.2A; −12V,0.3A	40W	–
NFS50-7608	+5.1V,7.0A; +12V,2.5A; −12V,0.7A	50W	60W
NFS75-7608	+5.0V,5.0A; +12V,3.0A; −12V,1.0A	75W	–

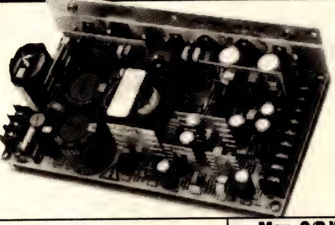
DC-DC Converter

(S) = Single output
(D) = Dual output
(T) = Triple output

Series	Input Voltage	Output Voltage	Max Output Power	Size L x W x H mm
PM600	5V; 12V	5V,0.1A/12V,0.08A(S)	1W	32 x 20 x 10
PM600	5V; 12V	±12V,.04A/±15V,.033A(D)	1W	32 x 20 x 10
A	5v; 12V; 24V; 48V	±12V,0.15A/±15V,0.15A(D)	4.5W	51 x 51 x 10
F	5V; 12V; 48V	5V,1A/12V,0.5A/15V,0.35A(S)	6W	51 x 51 x 10
AFC5	5V; 12V;	5V,1A/12V,0.4A/15V,0.35A(S)	5W	51 x 26 x 10
AFC5	5V; 12V	±12V,0.15A/±15V,0.15A/(D)	5W	51 x 26 x 10
PM900	5V; 12V; 24V; 48V	5V,1A/±12V,0.23A	5.5W	51 x 51 x 10
PM900	5V; 12V;	15V,0.4A/±15V,0.19A	6W	51 x 51 x 10
NFC40	24V; 48V	5V,8A/12V,3.5A/15V,2.8A(S)	40W	56 x 56 x 21
NFC40	24V; 48V	5V,7.5A; ±12V,0.75A(T)	40W	56 x 56 x 21
NFC40	24V; 48V	5V,7.5A; ±15V,0.75A(T)	40W	56 x 56 x 21

Universal Input (90-264VAC) 80W-350W

- MTBF > 65,000 hours
- Single output versions available on NFS110 series

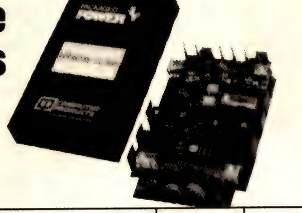


Model	Output Voltage & Max. Current	Max. O/P Watt	
		Free Air	Forced Air
NFS80-7602	+5.0V,12A; +24V,2.5A; +12V,3A; −12V,3A	80W	110W
NFS80-7606	+5.0V,12A; +24V,2.5A; +15V,3A; −15V,3A	80W	110W
NFS110-7601P	+5.1V,10A; +12V,5.0A; −12V,1A; −5.0V,1A	80W	110W
NFS110-7602P	+5.1V,10A; +24V,4.5A; +12V,5A; −12V,1A	80W	110W
NFS110-7604P	+5.1V,10A; +15V,5.0A; −15V,1A; −5.0V,1A	80W	110W
NFS200-7601	+5.1V,30A; +12V,8.0A; −12V,4A; −5.2V,6A	–	200W
NFS200-7602	+5.1V,30A; +12V,8.0A; −12V,4A; 24V,3A	–	200W
NFS200-7603	+5.1V,30A; +12V,8.0A; −12V,4A; 12V,4A	–	200W
NFS200-7608	+5.1V,30A; +12V,8.0A; −12V,4A	–	200W
NFS350-7608	+5.1V,50A; +12V,12A; −12V,5A	–	350W
NFS350-7625	+5.1V,50A; +12V,12A; −12V,5A; (Note 1)	–	350W
NFS350-7626	+5.1V,50A; +12V,12A; −12V,5A; (Note 2)	–	350W

Note 1: 4th floating output is adjustable 4.5V-16.5V, 4A
Note 2: 4th floating output is adjustable 15V-30V, 4A
*Absence of "+" or "−" indicates a floating output

Wide Input Range DC-DC Converters

(S) = Single output
(D) = Dual output
(T) = Triple output



Series	Input Voltage	Output Voltage	Max Output Power	Size L x W x H mm
DR	18-36V	5V,0.5A/12V,0.25A(S)	2.5W	32 x 20 x 13
DR	18-36V; 36-72V	±12V,0.125A/±15V,0.1A(D)	3W	32 x 20 x 13
FW	36-72V	5V,1.5A/12V,0.625A(S)	7.5W	51 x 51 x 10
FW	36-72V	±12V,0.315A/±15V,0.25A(D)	7.5W	51 x 51 x 10
NFC15	20-72V	5V,3A/12V,1.25A/15V,1A(S)	15W	51 x 41 x 12
NFC15	20-72V	±12V,0.625A/±15V,0.5A(D)	15W	51 x 41 x 12
ES	18-36V; 36-72V	+5V,1.5A; ±12V,0.31A(T)	15W	76 x 66 x 21
ES	18-36V; 36-72V	+5V,1.5A; ±15V,0.25A(T)	15W	76 x 66 x 21
NFC25	36-72V	+5V,5A; ±12V,1.0A(T)	25W	76 x 76 x 10
NFC25	36-72V	+5V,5A; ±15V,0.8A(T)	25W	76 x 76 x 10
WRU	36-72V	+5V,5A/12V,2.5A/15V,2A(S)	30W	116 x 66 x 21
WRU	18-36V; 36-72V	±12V,1.25A/±15V,1A(D)	30W	116 x 66 x 21
WRK	18-36V; 36-72V	5V,10A/12V,5A(S)	60W	140 x 99 x 23
WRK	18-36V; 36-72V	+5V,5A; ±12V,1.25A(T)	55W	140 x 99 x 23
WRK	18-36V	+5V,5A/±15V,1A(T)	55W	140 x 99 x 23

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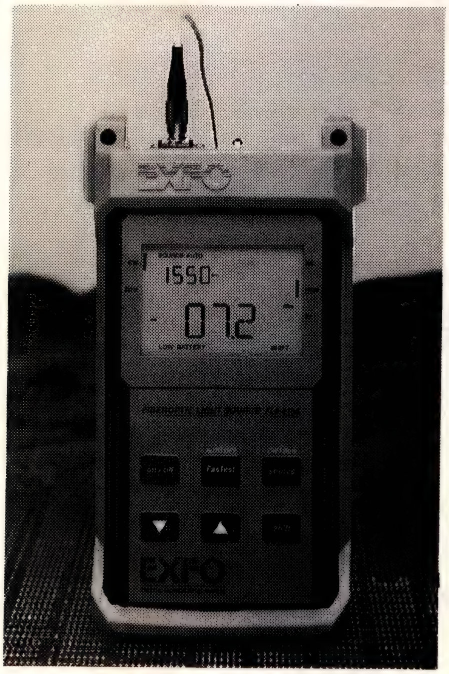
READER INFO NO. 24

NEW PRODUCTS

Variable optical light source



The FLS-210A is a portable, variable optical light source. This high performance light source is available in both laser (10dB variable range) and LED (low med, high) configurations.

Single wavelength (850nm, 130nm, 1310nm, 1550nm) and dual wavelength (850/1300nm, 1310/1550nm) versions are offered as well.

The FLS-210A allows automatic attenuation tests when used with EXFO's compatible FOT-90A or FOT-900 power meter. This can save time and money when testing high fibre count cables. Other features include battery (NiCad, alkaline) or AC powering, a rugged polycarbonate case, a protective PVC holster, large backlit LCD, low battery indicator and an auto-off function

For further information circle 241 on the reader service coupon or contact EXFO E.O. Engineering Inc, 465 Godin Avenue, Vanier, Quebec Canada, G1M 3G7; phone (418) 683 0211, fax 683 2170.

Smart home

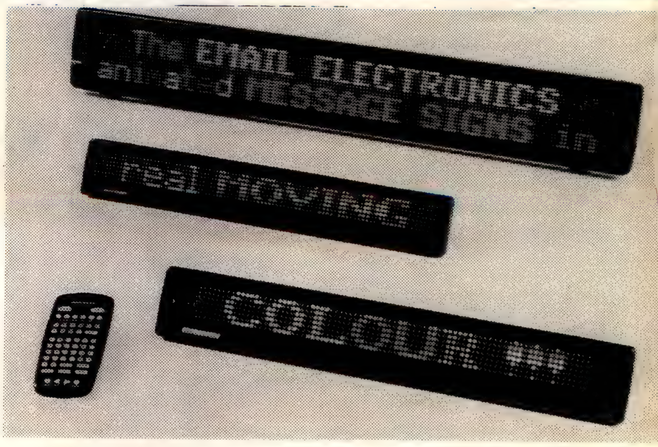
A home (and business) controller from Intellihome is a device that responds to spoken commands or push-button inputs. For instance, saying "I'm off to work" to the Intellihome might cause it to open the garage door, switch off all lights and appliances, adjust the thermostat for energy savings and arm the security system. Before leaving for holidays, the controller will respond to another spoken command such as "Bye home" and automatically switch on lights, TVs and stereos, creating a lived-in feel to the home to deter intruders. Should there be an intruder, the device will dial up to four numbers and give a warning (e.g., hotel, relative, colleague, security company). The operation of the controller can als
changed by phone. The Intellihome
existing wiring, and can cut
electricity bill by up to 50% a year.

For further information circle 242
the reader service coupon or con
Reachclue, 20/67 Lamont Stre
Wollstonecraft 2065; phone (02)
4268.

Analog multimeter

The Nishizawa 3001-01 analog mu
meter is a rugged, drop-proof instrum
with a sensitivity of 20k/volt DC an
basic accuracy of +/-2.5%. It has

Colour electronic message sign



The Alpha 200 series, 4000 series and Beta-Brite from Email are versatile indoor LED electronic message displays with high visual impact. The LEDs allow up to eight colours based on red, yellow and green.

In the sales, retail and hospitality industries they can typically be used to advertise 'specials', promote new product lines or advertise special events. In the factory environment they are excellent for displaying safety or production related information. The signs are also widely used in a reception area to welcome customers and special visitors or direct people to a particular area.

The units are available in a range of sizes from 734mm to 1630mm long and have 26 operating modes including rotate, scroll, wipe, hold, twinkle, spray, starburst, snow and automode, plus nine built-in animations.

The pre-programmed animations include fireworks, a moving car and 'don't drink and drive', 'no smoking', 'welcome', and 'thank you' messages. The signs are easily programmed with the hand-held infrared remote controller or via a PC. Up to 255 Alpha series signs can be networked. This is achieved using the optional AlphaNet Plus software and with modems used for remote installations, message signs locate
all over Australia for example, could be instantaneously updated from a central PC.

For further information circle 243 on the reader servic
coupon or contact Email Electronics, 15-17 Hume Street, Huntingdale 3166; phone (03) 544 8244, fax 543 8179.

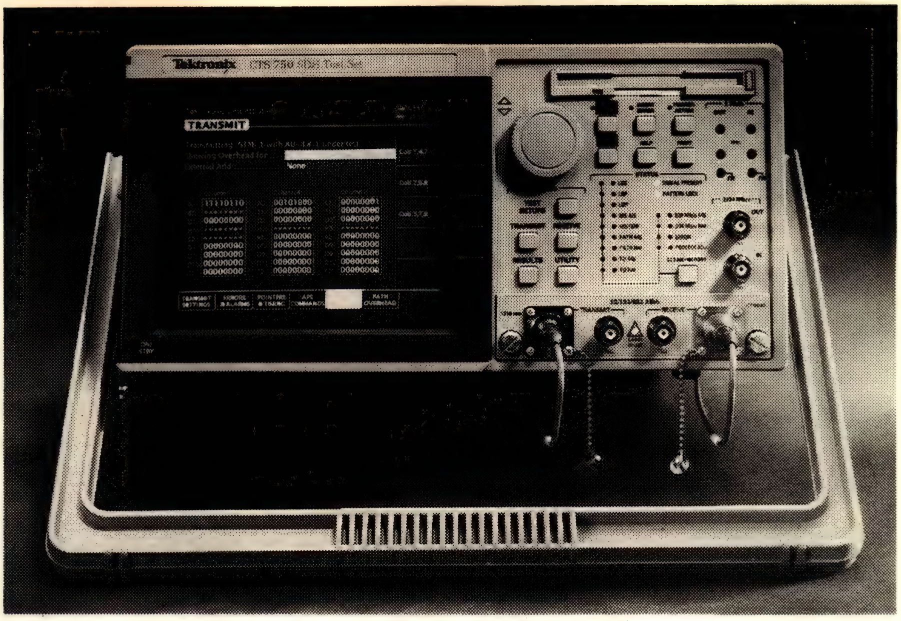
DH/SONET test sets

ektronix has announced the CTS 750
H test set and the CTS 710 SONET
set. Along with providing full SDH
nchronous digital hierarchy) or
NET (synchronous optical network)
nsmission test capabilities, these new
table test sets are easy to use.

Comprehensive monitoring
abilities are included, as well as
merous advanced features, such as
te manipulation, for detailed
ubleshooting and analysis. Additional-
both test sets are easily configured for
s/fail testing.

This is further supported with the
toScan and TroubleScan productivity
tures. The CTS 710 and CTS 750 are
o easily configured for new or chang-
needs. This is done through a flexible
hitecture that accommodates software
grades and various signal interface
g-ins and tributary cards.

For further information circle 246 on
the reader service coupon or contact Tektronix, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066, fax 888 0125.



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asuring ranges including measurements up to 1000V AC and
, current from 50uA to 300mA DC, resistance up to 1M and
attery tester function. The unit will also measure temperature
m -50 to 150°C using an optional thermister probe. Overload
otection up to 250V is provided by fuses in both the instru-
nt and test lead. The instrument is supplied with a set of
ety test leads, spare fuses and a hard carry case incorporating
ilt stand/carry handle.

For further information circle 244 on the reader service
upon or contact Nilsen Instruments, 18 Hilly Street, Mortlake
37; phone (02) 736 2888.

line amp for UHF/microwave

Miteq of New York have recently announced a new line of
v noise coaxial in-line amplifiers available in either the entire
1 - 20GHz range, or optimised in octave and multioctave
nds. Named the AFSX series, these amplifiers readily fit into
axial cable assemblies, receiving antenna systems, and any
st and measurement system without the usual mounting
oblems. These hermetically sealed and weatherproofed units
n be biased through the output, thereby eliminating cumber-
me wiring problems. The AFSX series can be used as drivers
gain blocks in test instruments, mounted directly behind the
itenna in satellite and radar systems, or as low noise gain
jualisers in receiving cables to receiver front ends which ef-
ctively provide a zero-loss cable.

For further information circle 250 on the reader service
oupon or contact Electronic Development Sales, PO Box 822,
ane Cove 2066; phone (02) 418 6999.

lamp on power meter

Meter International has released in Australia the MIC 2080W
andheld clamp-on, auto ranging power meter. It is designed
measure various electrical parameters without the need to
reak the circuit current. The meter features AC/DC current
ieasurement to 1000A and voltage to 650V AC or 1000V DC,
ieasuring true RMS. The MIC2080W can measure true power
200kW and frequency to 200Hz. The meter uses advanced
Iall effect technology to measure true RMS current accurately,
lmost regardless of the waveform, to a crest factor of three.
The measured value is displayed on a 3.5 digit liquid crystal display, with an analog output provided for monitoring the waveform of the current by record chart or oscilloscope.

For further information circle 247 on the reader service coupon or contact Computronics International, 31 Kensington Street, East Perth 6004; phone (09) 221 2121, fax 325 6686.

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READER INFO NO. 25

Special Feature:

NEW COMPONENTS

Fast source for ceramic resonators

Integrity Technology Corporation has announced additional ceramic resonator production capacity, offering a shortened lead time of six to eight weeks. Their low frequency resonators range from 320kHz to 970kHz, and their high frequency resonators range is from 3.2MHz to 12MHz. Typical frequency tolerance is +/-0.5%over an operating temperature range from -20°C to +80°C. Aging of frequency stability is +/-0.5% per year for 10 years.

For further information circle 203 on the reader service coupon or contact Integrity Technology Corporation, 1400 Coleman Avenue, Suite E15, Santa Clara, CA 95050-4358 USA; phone (408) 262 8640, fax 262 1680.

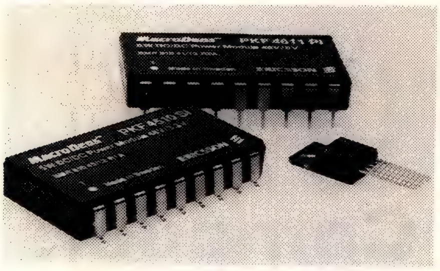
Snap-together keypad system

Available in combinations from a single cell unit up to a 10 x 10 matrix, the Vario Support matrix system enables the user to 'snap' switches in place for an endless number of configurations.

The versatility of the matrix is ideal for the assembly of custom data entry keypads, where development costs and lead time would normally be prohibitive. The system provides accurate switch alignment in horizontal and vertical rows, plus a variety of keypad layouts. Momentary and maintained switches, coloured caps and bezels, custom legends, and LED illumination can be combined in a single Vario-Support to produce a custom keypad.

For further information circle 202 on the reader service coupon or cont Erni Australia, Monomeeth Drive Mitcham 3132; phone (03) 874 85 fax 874 3160.

Integrated 7W DC/DC converters



A new component-like DC/DC converter has been announced by Ericsson. The dual in-line packaged DC/DC power module series PKF gives system designers an economical route to the advantages of distributed power modules in 48/60V DC battery backed-up systems.

Weighing only 15 grams, the typically 83% efficient (5V version) single output converter allows automated insertion for surface mount or through-hole mounting. Its height of 8mm allows board pitches down to 15mm. The 1500V DC input to output isolation conforms to EN 41003 and UL 1459.

The converters, any number of which may be directly paralleled, have output adjustability, a remote on/off function and a low input turn-off function that protects harmful discharging of the batteries during mains failures.

The PKF MacroDen products first scheduled have output voltages and power levels of 2V/3W, 3.3V/5W, 5V/6W and 12V/7W, all in through-hole and SMD versions.

For further information circle 201 on the reader service coupon or contact Ericsson Components East Asia, 17/F 151 Gloucester Road, Wanchai; phone (05) 192 388, fax 507 4684.

Illuminated switch from Multimec

The new 1K switch option from Multimec is available in both illuminated and non-illuminated versions. The square cap measures 14.3mm and may

be complemented by the addition of t 2K bezel which snaps into t designer's front panel.

Depending on the position of the I board behind the front panel, the 1K c can be extended, flush mounted, recessed within the 2K bezel providi a variety of different visual effects. T illuminated 1K option comes comple with high intensity LED illuminatio and offers the designer the option using interchangeable legends or stan ard printed graphics.

The Multimec switch module is tot ly sealed to IP-67M standards and has mechanical life rating of 10,000,0 cycles minimum, and an electrical ratir of 50mA at 24V DC. Standard opera ing temperature is -40°C to +65°C. high temperature option is availabl with an operating temperature of -40° to +160°C.

For further information circle 206 o the reader service coupon or contac Erni Australia, Monomeeth Drive 1 Mitcham 3132; phone (03) 874 856 fax 874 3160.

SMT inductors for VHF, UHF

VSI Electronics has announced th availability of AVX/Kyocera ACCU-I series of surface mounted RF inductor which are among the smallest high fre quency SMT inductors available. Th units, which come in an 0805 chip size

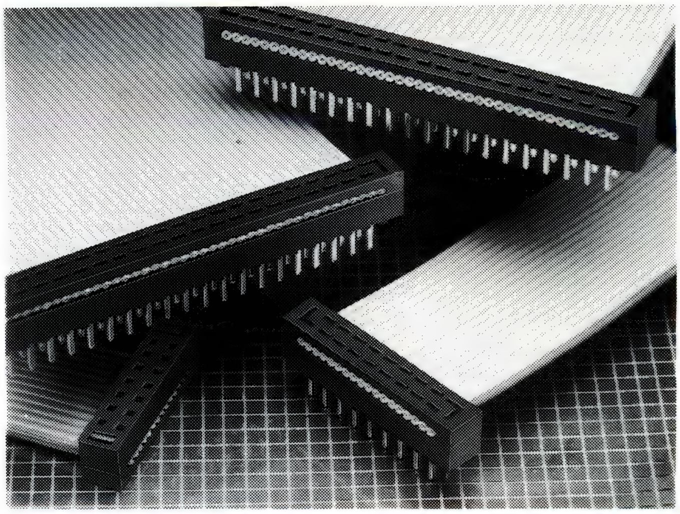
mm IDC connectors

A new micro IDC system with terminals on 2mm x mm pitch is now available from Samtec. The double ow TCMD series features 0.50mm (0.02") square phos- hor bronze pins and can be specified with two to 25 ositions per row. Notch and position polarisation are both vailable as standard options.

This cable assembly measures only 5mm (0.2") tall fully ssembled, for the lowest possible profile.

The TCMD series will mate with a number of Samtec hrough-hole and surface mount socket strips on 2mm centres. he series also complements Samtec's 2mm female IDC as- embly (TCSD series) which features tiger-eye contacts. ingle end, double end and transfer end (socket on one end ith terminal on other end) assemblies are available.

For further information circle 209 on the reader service oupon or contact NSD Australia, 205 Middleborough Road, ox Hill 3128; phone (03) 890 0970.



xhibit a high SRF, high Q, and low esistance. They are well suited for ap- lications from 100MHz to over 2GHz, ith self resonant frequencies ranging rom 2.2 to 10GHz. The series covers he range of 2.7 to 15nH with tolerances f +/-0.5nH and +/-5%.

For further information circle 204 n the reader service coupon or con- act VSI Electronics, 16 Dickson venue, Artarmon; phone (02) 439 655, fax 439 6435.

MKT interference suppressor caps

EVOX-RIFA have released the PHE820 and PHE830 series of X2 interference suppression MKT polyester film capacitors. Using series windings and advanced production techniques, these capacitors exceed the new passive and active flammability requirements soon to be adopted by the IEC. These requirements will ensure mains rated suppression capacitors cannot catch fire or support combustion under normal and adverse operating conditions.

The PHE820 is rated at 275V AC, while the PHE830 is a 250V AC device. Both cover a wide capacitance range from 10nF to 2.2uF. With international approvals from 20 countries and competitive pricing, this new series extends the already comprehensive range of EMI/RFI suppression capacitors from EVOX-RIFA.

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With PC Probe™ you'll save time and money when your PC starts acting up. In one easy-to-use package you get Diagnostics, Virus Protection (for over 700+ known viruses), Benchmarks (including the famous LandMark System Speed Test™), Performance Enhancement Utilities, and System Information. Combined, this arsenal of tools will keep your system up and running at peak performance and remove the mystery about what's inside.

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With **Alignit™** you can *clean, diagnose, and align* your floppy drives in minutes *without* a scope. Patented technology requires only screwdriver to perform ANSI-accurate alignments (.3 mil).

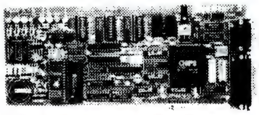
Alignit is *ideal for corporate users with* 2 or more PCs because it includes a "**GOLD STANDARD**" feature so you can align all your PCs to the same in-house standard, *guaranteeing that all your floppies are perfectly interchangeable* between PCs.

80% of all floppy drive failures can be fixed with Alignit so don't replace your drive, save time and money instead. Includes dual size floppies, (both high and low density) and no-mess pre-lubricated cleaning diskettes (both sizes) good for 180 uses. Replacements and single drive size versions available. For al PCs and compatibles.

PC WON'T BOOT? THEN JUST KICKSTART IT!

Don't replace your motherboard, don't call service, use **KickStart 2™**. When serious hardware problems occur, nothing gets you up and running as fast. KickStart 2 *measures power within 2.5%* on all four voltages, *shows Power-On Self-Test* (POST) failure codes, and features *on-board ROM-based diagnostics* allowing you to *determine and remedy the problem quickly, easily, and inexpensively!*

Built-in serial and parallel I/O *allows for testing via modem,* or simply logging results to a remote terminal, printer or laptop. You can configure your own test routines and store them in KickStart 2's battery backed-up CMOS RAM saving valuable setup time. Includes serial and parallel loopback plugs and Landmark JumpStart AT ROM BIOS for testing PCs that don't issue POST codes. KickStart 2 *tests your system regardless of O/S (even UNIX).*



On-board switches, LEDs, and digital displays allow complete control over testing in systems lacking video or disk (ideal for motherboard or system burn-in).

Kick Start 2 is the *ultimate SECURITY CARD* too! With both supervisor and user levels of password protection, you can prevent unauthorised use of your PC and accidental running of destructive tests.

HARD CORE TESTING FOR PROFESSIONALS

Landmark/SuperSoft **Service Diagnostics$_{TN}$** is ideal for professionals requiring the *most exhaustive diagnostic* test capabilities. Each module is CPU specific, including PC, XT, AT, 386/486, and PS/2. Since 1981 major manufacturers like Wang, Xerox, Prime, Sony, DEC, NEC, and NCR have relied on Service Diagnostics to tackle their tougest operating problems.

Intended for professional service and repair technicians, Service Diagnostics is also *easy to use* for the novice. Clear, concise on-line help and intuitive menus make finding system problems a breeze. Tests all CPUs, math chips, all memory, floppy, fixed and non-standard disk drives, standard/non-standard printers, system board, video, com ports and all keyboards. Utilities include low-level reformat, log bad sectors, edit bad sector table; the partition editor allows you to set up multiple partitions; *back-up program* transfers hard disk image on unformatted floppies and allows for *restore* after reformat.

Ideal for UNIX and other operating systems, the *self-booting version* doesn't require DOS. The manual offers troubleshooting tips to the component level. Also available in a complete Kit including; all CPU specific software, dual size floppy alignment software (see Alignit), and PC/XT & AT ROM POSTs. ***Winner of the PC Magazine Editor's Choice Award in August 1990.***

Interworld Electronics & Computer Industries (Aust) Pty Ltd
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READER INFO NO. 27

For further information circle 210 on the reader coupon contact or contact NSD Australia, 205 Middleborough Road, Box Hill 3128; phone (03) 890 0970, fax 899 5191.

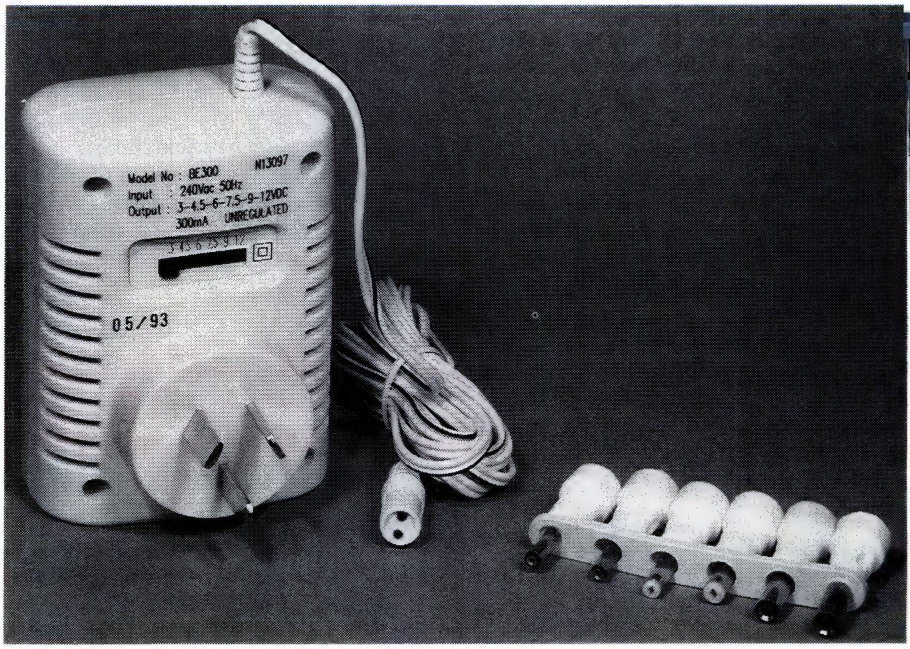
Suppression caps for 440V AC

RIFA has introduced a range of 440V AC suppression capacitors for applications requiring a high degree of safety and reliability.

Designed to withstand continuous operation at 440V AC, the PME 294 (for 'Y' or double insulated applications), covers a capacitance range from 470pF to 4700pF. These capacitors can withstand 4000V AC for 60 seconds and operate over a temperature range of -40 to +100°C. They have dv/dt ratings u to 2000V and self extinguishing encapsulation. The PME278R is an 'XI' class 440V AC, 110°C rate capacito designed to offer superior surge voltag resistance under the XI rating, with capacitance range of 1000pF to 0.15uF.

Both types use multilayer metallise paper construction, giving exceptiona transient voltage performance, excellen self-healing characteristics and hig ionisation resistance.

For further information circle 215 o the reader service coupon or contac NSD Australia, 205 Middleboroug Road, Box Hill 3128; phone (03) 89 0980, fax 899 5191.



Battery eliminator range

Recently formed component/accessory distributor Avico Electronics has released a range of 'plug pack' and desktop battery eliminator supplies designed to meet Australian safety standards, and incorporating some novel features. The range is known as the 'BE' series.

One feature is that the plug pack supplies are 'inverted' compared with many existing designs, extending upward from the three-pin plug section (and GPO socket) rather than downward. This allows the supplies to be used on GPO's mounted at floor level, as many are in modern buildings.

Another feature is that the output voltage selector switch is fitted to the input pin side of the supply, so that once set and the supply is plugged into the GPO, the switch is effectively concealed. This prevents accidental voltage changes, and protects the load equipment from being damaged. The front (visible) surface of the supplies is also fitted with an indicator LED, to indicate when power is present.

Some models in the range also have regulated output voltage, for powering equipment which is sensitive to the variations present in standard unregulated supplies.

Finally, all supplies in the Avico 'BE' range come with a set of DC output connectors including the new EIAJ miniature concentric type.

Further information is available by circling 240 on the reader service card or direct from Avico Electronics, PO Box 720, Seven Hills 2147; phone (02) 624 7977, or fax (02) 624 7143. ❖

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READER INFO NO. 30

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READER INFO NO. 31

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THE VERSATILE SA-572

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SPECIFICATIONS — SA-572:
- Input: 230V AC, 50/60 Hz • Iron: 70W, 230V
- Heater: Ceramic with Embedded RTD • Cord: 3-Wire, Austraian Plug
- Dimensions: 117.5mm x 115mm x 133mm • Shipping Weight: 1.1 kg

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READER INFO NO. 32

Silicon Valley NEWSLETTER

Quake boosts telecommuting

Los Angeles, the 'City on Wheels', had its tires blown out by the earthquake which destroyed many of the key traffic arteries that normally transport millions of people to and from work in the huge metropolis. Unable to get to work within a reasonable amount of time, thousands of workers and companies have been scrambling to initiate or expand telecommuting capabilities.

Telecommuting centres around the Los Angeles area which were previously struggling to survive are being swamped with desperate workers, in need of getting through to their company's computer system in order to perform critical functions. Computer retail stores are busy selling PCs, modems, fax boards and communications software to enable thousands of people to continue to perform their job in some capacity.

Industry analysts are already predicting that the telecommuting industry will receive a huge boost in the aftermath of the earthquake, not only in Los Angeles, but throughout the world as companies will finally wake up to the value of telecommuting capabilities.

A few days after the quake, the Los Angeles City Council voted unanimously to adopt a proposal to vastly expand an earlier pilot program that allowed some 400 city workers to work from home. A year ago, the same City Council voted down a similar recommendation to expand the program designed by Jack Niles, the 'guru of telecommuting' and the man who coined the phrase.

Until now, most companies have been reluctant to embrace telecommuting. Besides balking at the necessary investments in equipment, many managers have feared a loss of control over their workers and operations. In the wake of the quake, telecommuting evangelists are trying to capitalise on the opportunity created by the destruction of LA's commute infrastructure. "If nothing else, companies should look at telecommuting as a disaster preparedness tool," Niles said.

There are few places where the need for telecommuting has been demonstrated more clearly than in the Antelope Valley, 65 miles from downtown Los Angeles. Some 140,000 people commute daily from the area to LA. Now the main artery into the Los Angeles Basin has been destroyed, and aftershocks also damaged the only other way into the LA area.

"There is no way out of here," said Suzette Cecchina, who runs a telecommute centre in the Antelope Valley. "I foresee our centre will be used to 100% capacity. We are being inundated with calls and new customers."

The future may still look cloudy for 3D television, but 3D computer graphics loo set for wide spread applications sooner, rather than later. At the recent Comde show in Las Vegas, Digital Equipment was showing off the 3D capabilities of desktop machine based on its Alpha processor, running a dazzling thre dimensional flight simulation programme. The glasses required were still muc the same as with earlier systems — showing that there is a big marketin opportunity for someone to develop a better looking set.

Data superhighway: Oracle in fast lane

Oracle Systems, the Silicon Valley leader in large system database software, has stepped out of the shadows of its relative anonymity in a bold effort to crown itself as the standard setter in the developing market for data superhighway technologies, and the video-on-demand services that will be offered.

With Vice President Al Gore at his side, Oracle president and founder Larry Ellison announced a major deal to provide key data superhighway database software and hardware to Bell Atlantic, which is building a fibre based infrastructure on the East Coast.

Oracle is also expected to announce shortly the signing of agreements with Capitol Cities (which owns ABC Television), and other media giants to offer advanced information services.

Under the deal with Bell Atlantic, Bell will pay Oracle between US$30 million and US$50 million for the first of the company's 'media servers', a supercomputer based system connected to a vast array of disk drives which hold entire libraries of digitally compressed movies, television programs, books, magazines and shopping catalogs.

By the end of the year, as many as 250,000 Bell Atlantic customers should be able to use their telephone and television to interact with this vast multimedia database.

The Oracle media servers will be built around Ncube's massively parallel processing based supercomputers. Oracle owns a controlling interest in Ncube. Each of the servers will be able to ocess up to 25,000 video streams nultaneously; meaning up to 25,000 ople will be able to access the database the same time to order video, shop ctronically, or keep up with the latest ws. Oracle hopes to increase the pacity to 100,000 calls by 1995.

culley, McCracken in highway panel

Former Apple chairman John Sculley urned to the public limelight as joined Silicon Graphics presi- nt Ed McCracken to sit on Presi- nt Clinton's new 37 member ational Information Infrastructure lvisory Panel'. The panel is co- aired by Delano Lewis, who ads the National Public Radio or- nisation, and chaired by Ron own, the US Secretary of Com- erce. Its objective is to formulate blic policy on the development d implementation of a national ta highway infrastructure.

Although regulation policies will part of the panel's agenda, Mc- acken said there are many other sues that will need to be addressed ring what he estimates will be a ve to 10 year national effort. "If can get government and busi- ss working together, that's better an working separately."

Besides McCracken and Sculley, her high tech industry representatives the panel include Craig Fields, rmer head of DARPA and now ad of Micro-electronics & Computer chnology Corp. (MCC), Lotus evelopment co-founder Mitch Kapor, icrosoft vice president Nathan lyhrvold and computer industry wsletter publisher Ester Dyson.

Meanwhile Vice President Al Gore has peared in Silicon Valley to deliver a w White House policy speech on the sue of deregulation in the US telecom- unications industry. New policies will e aimed at allowing cable TV com- anies to compete with local telephone ompanies and visa versa.

While the Clinton Administration avours deregulation, it is trying to stay way from the Reagan-Bush philosophy f letting market forces determine how e data superhighway industry develops. linton and Gore, in traditional emocratic manner, want to try to ensure hat larger social goals are addressed in he move into the next generation of digi- al communications.

Before speaking, Gore visited the ona Vista High School in Cupertino where students learn from behind Macin- osh and PC terminals connected to the Internet network. Students showed Gore how they could easily access the Library of Congress and extract text of speeches Gore made on any given subject, while he was a Senator. They also called up file photos of Gore and his congressional voting record. And they showed how they are learning German by communicating over Internet with students at a high school in Germany. Under the rules of the program the US students must carry on a conversation in German, while the German students reply in English. While Gore was impressed, the vice president stunned the students with his working knowledge of the Internet network.

Apple irks famous astronomer

The seemingly innocent practice of giving a code name to new computers under development has caused Apple Computer to make an enemy out of one of the world's most renowned astronomers.

Carl Sagan of Cornell University was not amused when he found out through an article in MacWeek that Apple had used his name for a computer still under development. Sagan reportedly sent Apple chief Michael Spindler an angry letter, threatening legal action if Apple continued to use his name without his permission.

Apple officials were bewildered at first, as they never intended to use the name outside the confines of Apple's research laboratories. But the company announced it has decided to drop Sagan's name for the project, which is now simply called 'BHA'. Reportedly that stands for 'Butt-Head Astronomer'.

The BHA project involves a machine built around the PowerPC microprocessor and was scheduled for introduction in March. Two other PowerPC computers are also under development, under the code names 'PDM' and 'Cold Fusion'.

Ad-zapper in chip form

A week after Arista Technologies announced a new commercial zapping device at the Consumer Electronics Show in Las Vegas, the California company which invented the technology for the VCR-top device announced it will begin marketing the technology to VCR makers, who will be able to incorporate it into future models.

The technology was developed by Invention Management Associates of Encino in Southern California. The firm's president and inventor Jerry Iggulden said his company has developed a microprocessor and ROM based software package which eliminates television commercials from taped programs.

Iggulden said millions of consumers will be happy to pay a small premium for VCR models with the commercial zapper option. "People see TV commercials as a regrettable fact of life. This technology changes that." The IMA chip and software sense the 'black frames' which separate a program from blocks of commercials and which separate individual commercials within the block. The VCR automatically fast-forwards to the end of the last commercial, which is also marked by a number of black frames.

The software allows the VCR to distinguish between black frames within the program tape and those marking the beginning and end of commercials. For one, black frames are often inserted to separate one scene from the next. But this is almost always limited to one or two black frames. The commercial breaks are usually marked with groups of 10 or more black frames.

Black frames are television's punctuation marks," Iggulden said.

Although broadcasters could try to foil the ad zappers, when their use becomes more common, Iggulden said that is highly unlikely. "If you eliminate the black frames separating commercials, it would be very jarring to viewers. It will look as if the Tidy Bowl Man is in the Kellogg's cereal commercial. It would also be very expensive for broadcasters to change."

IBM reclaims patent leadership

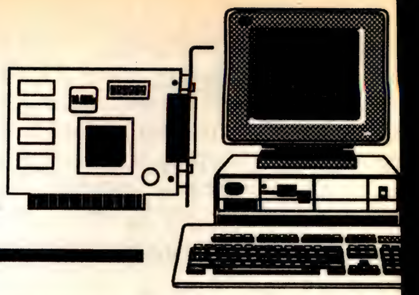
After seeing Japanese companies pull ahead in technological leadership, IBM has reclaimed world leadership in the number of awarded technical patents. Last year, IBM was granted 1088 patents by the US Patent Office. It is the first time since 1985 that an American company has held the top spot.

With Eastman Kodak in fourth place with 1006 patents, the 1993 results are another indication that US industry is slowly turning the tide on the competitive assault the Japanese unleashed during the 1980's.

Despite the US gains, Japanese companies still owned six of the 10 spots on the list of companies with the most new patents in 1993. Toshiba was the top ranking Japanese company with 1640 patents. Canon followed closely with 1039. Others on the Top 10 list included Hitachi, fifth with 949 patents, followed by Mitsubishi with 944 patents. General Electric was seventh with 942 patents, Motorola eighth (731), Matsushita (722) and finally, Fuji Film with 634 patents.

IBM's invention rate was 28% higher than in 1992 — remarkable at a time when IBM made sharp cuts in many areas of research and development. In 1992 IBM ranked sixth, with just 852 patents. ◆

Computer News and New Products



Fast real time kernel for RISC processors

Baltec Systems has now released AMX 3000, a real time multi-tasking executive for the MIPS R3000, LSI Logic LR3000A and LR330x0, and compatible RISC processors from KADAK Systems. The Executive is written in portable C and includes the source code to allow porting to all the popular compiler toolsets. It provides pre-emptive priority scheduling for optional time slicing. Separate managers control message passing, semaphore signalling, resource allocation, event synchronisation, list manipulation, and dynamic memory allocation.

The software is available with a one time site licence and implements all standard AMX procedures at high speed in the difficult RISC multi-tasking environment. A demonstration disk is available from Baltec Systems.

For further information circle 162 on the reader service coupon or contact Baltec Systems, PO Box 107, Paddington 4064; phone (07) 369 5900, fax (07) 369 5257.

Precision frequency synth

Interworld Electronics has announced the release of the GT310 Frequency Synthesiser card from Industrial Computer Source, which delivers precision pulses from 360kHz to 120MHz. The GT310 is a half-slot PC compatible plug-in card with four independent phase locked loop (PLL) frequency synthesisers.

The standard GT310 uses a 10MHz crystal oscillator with an accuracy of +/-100ppm at 0 to 50°C. The high stability model GT310-10 provides a frequency accuracy of 0.0001% by using a 10MHz crystal with an accuracy of +/-1ppm at 0 to 50°C and a known aging rate of less than 1ppm/yr.

An external clock input allows the card to be locked to any frequency from 1MHz and 35MHz. Each channel can individually select either the internal or ternal reference.

The FT310 provides both pulse burst mode operation. In pulse mode, ses with lengths of 100ns to 429s can generated. In burst mode, streams of ses can be produced. Burst mode can triggered from an external hardware t ger, a second channel or under prog control. A 15-pin D connector provi the output signals from the freque synthesisers and BNC connectors used for the external trigger input and pulse output of channel 0.

GT310 applications include; cont variable speed motors precisely, meas filter response, reduce FFT errors by t gering data acquisition at exact multip of a signal frequency, produce pulses t are accurately delayed from an exter trigger, generate multiple clocks fron single source, etc.

For further information circle 164 the reader service coupon or contact terworld Electronics & Computer

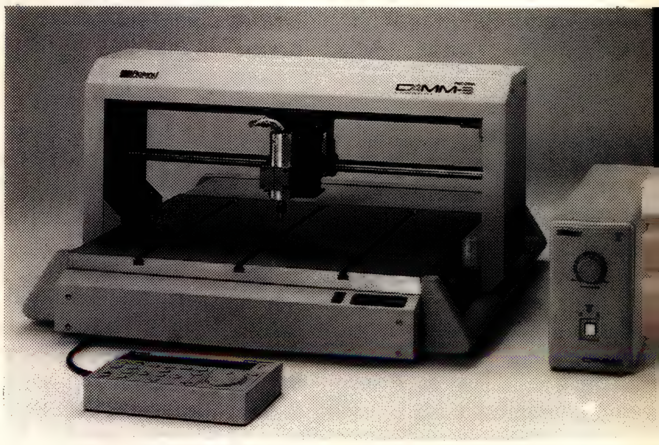
Computer aided engraver

The new PNC-2700 engraver from the Roland CAMM-3 series is a precision, desktop, engraving device that combines all the advanced engraving capabilities of large, expensive machines into a compact, affordable model. Like other CAMM-3 models, the PNC-2700 achieves full 3D output.

The engraver accepts a 500mm x 330mm work area, allowing the production of display signs, large engraved or milled facility signs, as well as drilling and trimming for circuit boards. In addition, the PNC-2700 has an exclusive controller keyboard to adjust the position of the X, Y and Z axes.

Maximum engraving speed of the PNC-2700 is 3.6m/minute and the standard 1MB buffer frees the computer quickly. The PNC-2700's commands are based on HP-GL emulation, which means it can be driven from PCs, Macintoshs, CAD workstations and commercially available software for each platform. These commands include a subset for controlling the spindle's three axis movements. The 0.01mm/step resolution allows precision results on the most intricate designs.

For further information circle 161 on the reader servi coupon or contact Roland Digital Group, 573 Church Stre Richmond 3121; phone (03) 428 1088.



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stries, 1000 Glenhuntly Road, Caul-
d South 3162; phone (03) 563 5011.

51 family emulator

he MICE-51 emulator development
stem for the 8051 microcontroller
nily includes an in-circuit emulator,
nbolic debugger and a cross assembler.
he emulator supports 8051, 80C51,
52 and 80C52 as well as 8031, 80C31,
32 and 80C32 microcontrollers. Source
el debugging of ASM, PL/M-51 and C
ograms is supported. Intel OMF-51 and
el HEX file formats are supported.
he emulator connects to the PC COM
rt with an RS232 cable. A 40-pin pod
d flat cable connects the MIC-51 to the
get system. Up to 48K RAM of emula-
n memory is available and EEPROMs
also supported. The emulator has its
vn display and keyboard for inde-
ndent operation or it can be controlled
m the MBUG software running on a
C. MBUG provides a menu-driven win-
wed environment for developing as-
mbler or high level language software.

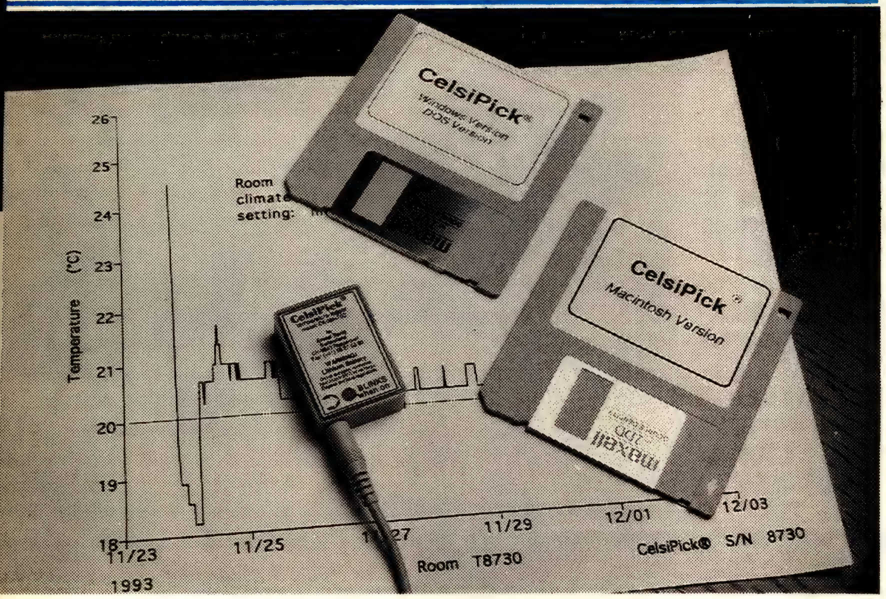
The MBUG cross assembler can assemble a source file and produce an object file for downloading to the MICE-51.

The complete MICE-51 package includes an in-circuit emulator with 8KB RAM, 40-pin pod and connecting flat cable, RS232 cable, disk containing MBUG symbolic debugger and assembler software with example programs, software user guide and hardware operation manual.

For further information contact Happy Bright Investments, Room F, 6th Floor, 1 Fleming Road, Hong Kong; phone (852) 891 3673.

JPEG video compression card

Zatek Components has announced the availability of a JPEG video compression card based on the C-Cube CL550 JPEG compression processor. This card installs as a daughter card on the Auravision VxP500 video I/O board, to provide real time JPEG video or still image compression.



emperature data logger

The matchbox sized CelsiPick
emperature/time/date logger stores a
naximum of 2000 temperature values
within its range of -35°C to +75°C. The
emperature probe, electronics, non-
volatile EEPROM memory and a lithium
attery are contained in the module. The
000 datasets can be sampled within 15
ninutes in 0.5 second steps or in one
year in five hour steps. The stored data is
safe from battery failure and low con-
sumption of 12uA allows a battery
life of two years.
The module is either launched or read-
out with a PC or a Mac computer, with a
user friendly software program supplied.

The module temporarily connects by a serial data cable to a PC (or compatible) serial port or a Mac (printer or modem serial port) to load the requested mission instructions or to read-out its collected data.

After launch operation, the module is disconnected and immediately starts its data collection mission. An individual, non-erasable serial number and a task assignment description added at launch permits an error free assignment of read-out data.

For further information contact Dipl Ing Ernest Spirig, PO Box 1140, CH-8640, Rapperswil, Switzerland; phone (41) 55 27 4403 or fax (41) 55 27 5369.

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The card features compression at resolutions of 320 x 240 and greater, at 30 fields per second. Compressed data rates of up to 1.0MB/second allow for a full range of video quality levels and resolutions on most PC platforms.

The Auravision VxP500 is ideal when used with the C-Cube CL550 in low cost PC multimedia system designs, providing video capture, advanced scaling support, VGA overlay and other functions. In a typical capture/compression operation, the VxP500 receives raw digitised pixel data from a PAL/NTSC decoder. The VxP500 can optionally scale the incoming frames before storing them in its frame buffer. The pixel data in the buffer is then routed to the CL550 for compression. In playback mode the CL660 decompresses video data from the ISA bus and directs this to the VxP500.

One of the main benefits is the ability of the VxP500 to perform high quality prescaling of incoming video fields prior to JPEG compression. This allows high quality video at reasonable disk I/O rates. During playback, the VxP500 can use its scaling and filtering support to zoom the decompressed video images to any desired resolution at a very high quality level.

For further information circle 165 on the reader service coupon or contact Zatek Components, PO Box 397, West Ryde 2114; phone (02) 874 0122.

QmodemPro for Windows integrates fax and data

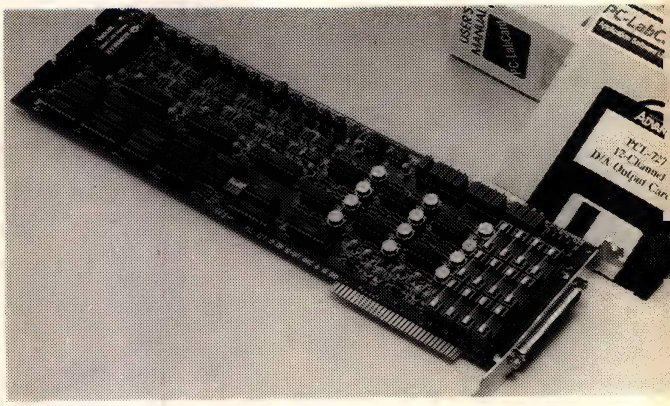
Banksia Technology has introduced a Windows version of the popular QmodemPro communications software package, and is the first program to offer support for both data and fax communication in one integrated package. It enables users to transfer files with a full slate of protocols including Zmodem, Kermit and CIS B+, and supports more than 30 terminal emulations, plus macros and programmable keys. It also supports LAN modem sharing devices and includes RIPscrip graphics in a true Windows environment.

A built-in GIF viewer allows users to view GIF graphics files as they are downloaded. They can zoom any GIF or BMP file, and even mark and copy portions of the picture to the Windows clipboard. Users can easily upload files usin drag-and-drop from the Windows Fil Manager to QmodemPro's upload window. Besides offering full data communications, QmodemPro for Window integrates send and receive fax support Using any Class 1 or Class 2 fax modem the program can send text files as well a PCX and BMP graphics files. Cove pages can be attached to these documents. Automatic fax receive is supported and a complete fax viewer includes thumbnail sketches, zooming copying and printing.

QmodemPro for Windows allows users to take advantage of the Windows multitasking environment. They can download files or capture data in the background while working in a word processor spreadsheet. It is available through resellers at a recommended retail price of $249. Existing users of any other communications software may upgrade or crossgrade to QmodemPro for Windows for only $99.

For more information circle 170 on the reader service coupon or contact Banksia Technology, 83 Longueville Road, Lane Cove 2066; phone (02) 418 6033.

12-channel D/A output



The PCL-727 is an economical solution for multiple PID control loop applications. It provides 12 channels of 12-bit D/A output on a full size PC card. Each channel's output range can be configured to 0 - +5V, 0 - +10V, +/-5V or 4 - 20mA current loop (sink). An onboard DC/DC converter ensures that full 10V D/A output is always available.

Fuses on each analog output channel (housed in easily accessible sockets) protect the card, PC and current controlled devices from power surges.

In addition to its analog outputs, the PCL-727 provides 16 digital output channels and 16 digital input channels. These TTL compatible ports easily interface with Advantech's line of daughter boards for use in industrial ON/OFF control and sensing applications.

For further information circle 168 on the reader service coupon or contact Priority Electronics, 23 - 25 Melrose Street, Sandringham 3191; phone (03) 521 0266.

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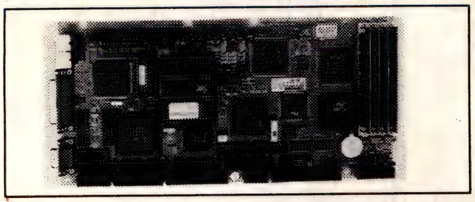
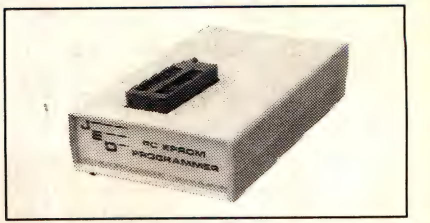
Australian Computers & Peripherals from JED... Call for data sheets.



$125 PROM Eraser,complete with timer



The JED 386SX embeddable single board computer can run with IDE and floppy disks, or from on-board RAM and PROM disk. It has over 80 I/O lines for control tasks as well as standard PC I/O. Drawing only 4 watts, it runs off batteries and hides in sealed boxes in dusty or hot sites. It is priced at $999 (25 off) which includes 2 Mbytes of RAM.

$300 PC PROM Programmer.

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Need to programme PROMs from your PC?

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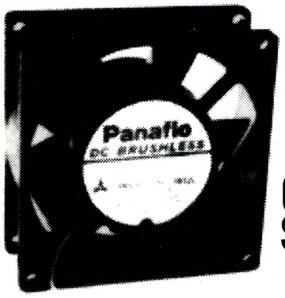
You could pay around $25.00 for a fan made in Taiwan.
These are only $15.00. So they won't last!



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DB9 Plg to DB25 Plg	$5.45

HDD15 to HDD15

HDD15 Plug to Plug	$7.95

25 to 25

25 to 25 M/M Bender	$7.95
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5 up $80.00

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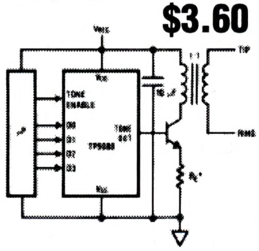
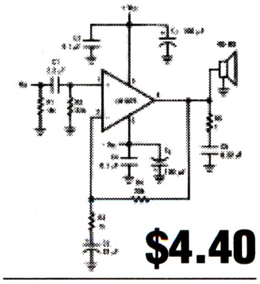
The TP5088 is a CMOS device providing low cost tone-dialling capabilities in microprocessor controlled telephone applications. 4-bit data is decoded directly without any need for conversion. Features direct μP interface, latches for binary data. Generates 16 standard tone pairs. On-chip oscillator. Low power stand-by mode.

$3.60



LM1875 20Watt Power Audio Amplifier

The LM1875 delivers 20W in to a 4 or 8Ω load using ±25V supplies. Using an 8Ω load with ±30V over 30W can be achieved. Requires a minimum of external parts. See project in Dec 93 Silicon Chip.



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LM3914/LM3915

Automotive Oxygen Sensor Tester. See E.A. Jan 94. Both linear LM3914 and Log LM3915 in stock **$4.75** each

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- ***High energy fuse and PTC protection against overloading***
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- ***Protective holster and tilt stand with lead storage***
- ***Test probes have finger shields and sleeved plugs***
- ***Thick walled ABS case and shock mounted LCD withstands 2m drop on to concrete floor***
- ***Unique rotary switch with berylium copper contacts and gold plated pcb***

Model 103

- 4000 count
- Data hold & Relative functions
- 0.1% (105) or 0.5% (103) dc accuracy
- 8 functions inc frequency and capacitance

APPA

Appa 88	$ 94.80*
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It's Always Wood for Chips!

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AM3705CN	8/1 Analogue Mux	$11.50
LF13201N	Quad SPST Sw. NC	$9.20
LF13202N	Quad SPST Sw. NO	$6.70
LF13331N	Quad SPST Switch	$6.50
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LF13509N	4 Channel Mux	$12.65

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4N25	Coupler Trnstr Out	$1.05
4N26	See 4N25	
4N28	See 4N25	
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6N139	Coupler, Lo Sat Hi G	$7.90
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A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

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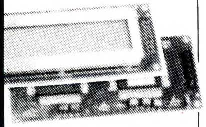
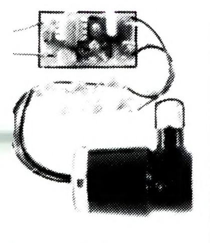
16 X 2 DISPLAYS



ese industrial quality, gh temperature, 16 X 2 aracter displays are easy drive (ASCII). mensions: 80 X 45 X)mm, character size 8mm, +5V supply. Also quire a low current gative voltage supply -10V) and an external mpot for contrast control.

$25 ea.
or 5 for $100

IMAGE INTENSIFIER TUBE AND SUPPLY

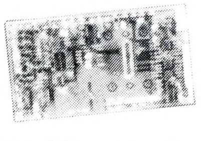


hese are the key omponents needed for naking a PASSIVE NIGHT 'IEWER. The small refocussed Russian image ntensifier tube only equires a low current EHT ower supply to make it perational, which we rovide in kit form: Draws 0mA from a small 9V attery. With a suitable ow light objective lens (not rovided) the resultant iewer will produce useful ictures in sub-moonlight lumination, and it can also e IR assisted. NCREDIBLE PRICE:

$150

or the Russian image ntensifier tube and HT power supply kit. ll that is needed to nake a complete assive night viewer s a lens, an eyepiece, 9V battery, a case nd a switch.

CCD SCANNER CARD



These CCD scanner cards were made by NEC for high resolution line scanning applications. They feature a 4096 element single line CCD element which is centrally located on the PCB. Information and circuit provided.

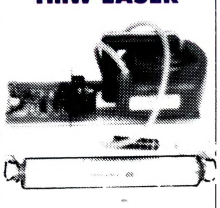
$65

FIBRE OPTIC CABLE

High quality twin core fibre optic cable. Inner core diameter: 10 uM, cladding: 500uM, outer protection jacket diameter: 3mm. Bargain at:

$10
for 6 meters

1mW LASER



This compact laser and supply combination is supplied with a used 1mW He-Ne laser tube. The switched mode inverter supply draws approximately 600mA from a 12V battery. Very efficient. Very easy to construct since no coil winding, or rewinding is required. The tube plus the supply kit are priced at an incredible total price of:

$49

3/2 LCD DIGIT PANEL METER

The key components needed in constructing a 3/2 digit LCD panel meter are the LCD display, and the 7106 IC: 3 1/2 LCD digit driver. Our price for this pair is a low:

$20

For the most recent project panel meter project which uses these components see S.C. Sept. 1992.

STEPPER MOTOR DRIVER KIT

This kit will drive two stepper motors: 4, 5, 6 or 8 eight wire stepper motor from an IBM computer parallel port. A separate power supply is required to run the motors. A detailed manual on the COMPUTER CONTROL OF MOTORS plus circuit diagrams/descriptions are provided. Note that no stepper motors are provided with this kit. We also provide the necessary software on a 5.25" disc. Great "low cost" educational kit:

$35

STEPPER MOTORS

These are brand new units, main body has a diameter of 58mm and a height of 25mm. Will operate from 5V, has 7.5deg. steps, coil resistance of 6.6 ohms, and it is a two phase type: Six wires. ONLY:

$14

PRECISION STEPPER MOTORS

This precision 4 wire Japanese stepper motor has 1.8 degree steps: That is 200 steps per revolution! 56mm diameter, 40mm high, drive shaft has a diameter of 6mm and is 20mm long, 7.2V-0.6A DC. We have a good, but LIMITED supply of these brand new motors:

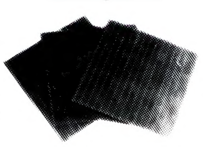
$20

5mW VISIBLE LASER DIODE KIT

Our lowest priced visible laser diode kit every! This one is supplied with a 5mW-670nM diode, a suitable adjustable lens/heatsink that accommodates the diode, and a PCB and all onboard components kit for a driver kit that features Automatic Power Control (APC). The mounted "head" has a diameter of 11mm and is 22mm long, APC driver PCB is 20 X 23mm, 4.5-12V operation at approximately 80mA. Incredible price:

$76

SOLAR PANEL BARGAIN

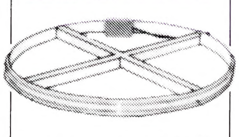


Brand new 6 volt 1 watt amaphourous solar panels, 150m X 150mm, will deliver one watt whilst charging 6-8V batteries. Two of these in series makes a great 12V battery maintainer/charger. Terminating clips are provided, but weather proofing of the rear is necessary. Instructions provided. INCREDIBLE PRICES:

$11 ea.
4 for $40, 10 for $80

12V solar regulator and charge indicator PCB and components kit — $8. See S.C. March ;92.

MASTHEAD AMPLIFIER KIT



Based on an IC with 20dB of gain, a bandwidth of 2GHz, and a noise figure of 2.8dB, this amplifier kit outperforms most other similar IC's, and is priced at a fraction of their cost. The cost of the complete kit of parts for the masthead amplifier PCB and components and the power and signal combiner PCB and components is PRICED AT AN INCREDIBLE:

$20

For more information see a novel and extremely popular antenna design which employs this amplifier: **MIRACLE TV ANTENNA** — E.A. May 1992: Box, Balun, and tinplate for antenna (slightly different design): $6 extra. Plugpack $12.

LASER LIGHT SHOW

Finally an affordable Laser Scanner that can draw stars, circles, squares and even text! The complete kit includes two galvos, computer interface, manual, and the software. Works from a parallel printer port. Incredible introductory price:

$290

ELECTRIC FENCE KIT

SC April 93. A complete kit for an electric fence controller mounted on one PCB. Even the high flyback transformer is mounted on the PCB. Can be powered by a 12V battery which is charged by our SOLAR CHARGER KIT, or a small plugpack, etc. Draws an average current of 15mA or 25mA depending on the mode selected: Low power — up to 1kM, high power — up to a few kilometers. Delivery a healthy kick of 2.3KV into an open circuit and 1.8KV into 500 ohms, and conforms to AS3129.

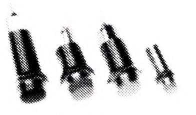
$40

HARD DISC DRIVES

These are BRAND NEW 10M IBM HARD DISK DRIVES: Originally made by Seagate Technology. Sure their capacity is not up to modern standards, but look at the price! Overall dimensions: 148 X 85 X 208mm. Limited quantity:

$39

INDUCTIVE PROXIMITY SWITCHES



These industrial quality detectors will detect ferrous and non-ferrous metals at close proximity. Some are DC powered (10-30V), some are mains AC powered, and all will switch loads directly. All have three wires for connecting into circuitry. Two for the supply, and one for switching the load. These also make excellent sensors for rotating shafts, etc. LIMITED SUPPLIES. **ON SPECIAL AT:**

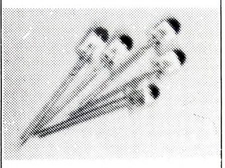
$22 ea
or 6 for $100

BRAKE LIGHT INDICATOR KIT

Includes two long skinny PCBs, 60 high intensity LEDs and 10 resistors. That's all you need to make a very bright, 600mm long brake light LED display, similar to the type included on some late model vehicles. ON SPECIAL:

$30

HIGH INTENSITY LEDs



Narrow angle 5mm red LEDs in a clear housing. Have a luminous power output of 550-1000mCD @ 20mA. That's about 1000 times brighter than normal red LEDs. Max. 1 = 100mA. SPECIAL REDUCED PRICE:

50c
or 10 for $14, or 100 for $30

40KHz ULTRASONIC PARTS

The difficult parts needed for making a good quality crystal controlled ultrasonic movement detector (EG. EA Apr. 90, S.C. July 89) are a pair of good quality 40KHz transducers (Murata) plus a 40KHz crystal. We can offer this set of three parts at a giveaway price of:

$6

400 X 128 LCD DISPLAY MODULE — HITACHI

These are silver grey Hitachi LM215XB dot matrix displays. They are installed in an attractive housing and a connector is provided. Data for the display is provided. BRAND NEW units at a low:

$50

SOLID STATE "PELTIER EFFECT" COOLERS

Available late March '94. Large 12V Peltier effect devices, matching heatsinks and fans. These parts make up the heating-cooling "Engines" that are used in expensive solid state thermoelectric coolers: Portable electric coolers and many other more scientific applications. We expect to sell a set of these components for under:

$50

LASER BEAM COMMUNICATOR

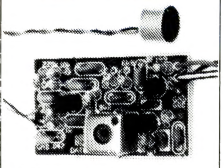
See E.A. Jan. 94. This popular Tx-Rx kit is easier to construct as we now include an adjustable heatsink-lens assembly for the laser diode, at no extra cost. IR LED version:

$30

Optional laser diode plus lens assembly:

$25

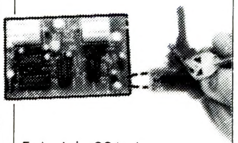
FM TRANSMITTER KIT — MKII



SC Nov. 93. This low cost FM transmitter features pre-emphasis, high audio sensitivity as it can easily pick up normal conversation in a large room, a range of well over 100 metres, etc. It has excellent frequency stability. Specifications: Tuning range: 88-108MHz, supply voltage 6-12V, current consumption @ 9V: 3.5mA, pre-emphasis: 75uS, frequency response: 40Hz to greater than 15KHz, S/N ratio: greater than 60dB, sensitivity for full deviation: 20mV, frequency stability with extreme antenna movements: 0.03%, PCB dimensions: 1" X 1.7". The double sided, solder masked and screened PCB also makes for easy construction and no coil winding is necessary. The kit includes a PCB and all the on-board components, an electret microphone, and a 9V battery clip.

$11
or 3 for $30

ELECTRONIC KEY KIT



E.A. July 92*. An IC on a small PCB which is shaped like a key (no battery), which when connected to two terminals that are wired to a decoder kit can be used to activate door strikers, car alarms, central locking, etc. Over 1/2 million codes. The most secure key ever. ON SPECIAL AT

$50

for two keys and one decoder kit.

OATLEY ELECTRONICS

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Telephone: (02) 579 4985 Fax: (02) 570 7910
MAJOR CARDS ACCEPTED WITH PHONE AND FAX ORDERS
P & P ANYWHERE IN AUSTRALIA
FOR MOST MIXED ORDERS: $2.50-$10

READER INFO NO. 2

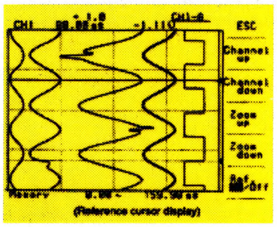
Universal Oscillographic Recorder Handles High Speed Transients As Well As DC

Just Released New Model offers –

- *Floppy Disk Storage*
- *Larger Memory Capacity (1MB)*
- *Powerful Computation Functions*

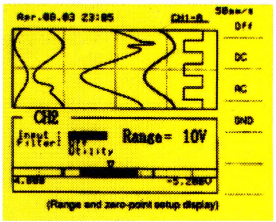
Yokogawa ORP1200 combines pen recorder, oscilloscope, logger and XY recorder in a single instrument

- ***Eight channel real time monitor, X-Y and digital recording***
- ***Industrial grade keyboard***
- ***Multi-point input with 8 analog and 16 digital channels***
- ***14 bit high resolution measurements***
- ***Large memory capacity – 128k/channel (4 channel mode)***
- ***A4 report generation with 100mm/s high quality recording***
- ***Powerful triggering – logic and pre- or post-trigger functions***
- ***High voltage model for power line applications to 500V***
- ***Universal model with TC and voltage***
- ***Logic input model with 16 channels***
- ***Cursor read-out of digital values with zoom and scroll***
- ***Rotary knob for analog recorder set-up***



(Reference cursor display)

Ideal for monitoring power line disturbances, switchgear and power waveforms etc. and diagnosing faults in distribution systems using comprehensive pre- and post-trigger functions.



(Range and zero-point setup display)

Set up like an analog recorder for testing dynamic motor characteristics and analysing hot and cold variations in vibration and other performance characteristics of mechanical equipment.

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